TERRAIN CLASSIFICATION SYSTEM FOR BRITISH COLUMBIA

(Revised Edition)

1988

Recreational Fisheries Branch
Ministry of Environment
and
Surveys and Resource Mapping Branch
Ministry of Crown Lands
Province of British Columbia

MOE Manual 10

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TERRAIN CLASSIFICATION SYSTEM FOR BRITISH COLUMBIA
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A system for the classification of surficial materials, landforms and geological processes of British Columbia

MOE Manual 10

Contributing Editors

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and
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RECREATIONAL FISHERIES BRANCH
MINISTRY OF ENVIRONMENT
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PREFACE

The purpose of this manual is to provide an updated and revised edition of the Terrain Classification System produced by the British Columbia Ministry of Environment in 1976 (E.L.U.C.S., 1976). Since its introduction, this mapping scheme has been used extensively by various Provincial and Federal Government agencies, as well, as by private companies. During this time period, the classification has been modified to improve its application for several kinds of land evaluations. This update incorporates these modifications and has been undertaken to ensure that terrain maps are uniformly prepared and of high quality. It also ensures that an empirically supported, qualitative, standard terrain data base system for both terrain and multiple resource interpretations is available for the Province of British Columbia.

The Terrain Classification System is based upon a classification system designed for mountainous terrain originally introduced by R. Fulton of the Geological Survey of Canada and presented at the workshop, "Base Data Inventories for Canada's Northlands", held in Toronto in April, 1974. It formed the basis of the British Columbia's 1976 edition of the classification (E.L.U.C.S., 1976). The latter document was prepared by the staff of the Resource Inventory and Analysis/Interpretation Divisions of the Resource Analysis Unit, Environment and Land Use Committee Secretariat, British Columbia Department of Environment. The authors of that published manual included: N. F. Alley, A. N. Boydell, J. M. Ryder, D. E. Howes, M. E. Walmsley, A. Pattison, B. Thomson, T. Vold and R. Beale.

This revision of the Terrain Classification System is based on, and draws heavily from, the following sources: (1) the original 1976 document, (2) an unpublished draft document of the terrain classification system prepared for the British Columbia Ministry of Environment by J. M. Ryder, (3) suggestions and ideas contributed by several terrain mappers within the Province of British Columbia (see Acknowledgments), and (4) material developed by the contributing editors. Revisions have been kept at a minimum, thus, users familiar with the 1976 version of the classification should have no problem adapting to the changes (see Appendix IV for summary of changes). The text does not provide information about mapping techniques and field sampling procedures. Further information about the classification, particularly for the non–specialist, is available in "A User's Guide to Terrain Maps in British Columbia" by Ryder and Howes (1984). Regional terrain reports and maps available in British Columbia are listed in a catalogue prepared by Maps BC, Surveys and Resource Mapping Branch, British Columbia Ministry of Crown Lands.

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The final version of this classification was reviewed by H. A. Luttmerding of the British Columbia Ministry of Environment, S. C. Chatwin of the British Columbia Ministry of Forests, and T. P. Rollerson of MacMillan Bloedel Ltd.

Photographs were provided by H. Baender, M. Fenger, D. Howes, E. Kenk, R. Maxwell, J. Ryder and B. Thomson.

TABLE OF CONTENTS

PREFACE ii

ACKNOWLEDGMENTS iii

TABLE OF CONTENTS iv

LIST OF FIGURES vi

LIST OF TABLES viii

INTRODUCTION 1

EXAMPLE TERRAIN UNIT SYMBOL 2

TEXTURE OF SURFICIAL MATERIALS 3

- Textural Terms and Symbols 4
- Definition of Textural Terms 4
- Application of Textural Terms 7
- General Use of Textural Terms 8

SURFICIAL (GENETIC) MATERIALS 10

- Surficial Material Terms and Symbols 10
- Definition of Surficial Material Terms 11

SURFACE EXPRESSION 26

- Surface Expression Terms and Symbols 26
- Application of Surface Expression 27
- Definition of Surface Expression Terms 27

GEOLOGICAL (MODIFYING) PROCESSES 39

- Geological Process Terms and Symbols 39
- Application of Geological Processes 40
- Definition of Geological Process Terms 40

QUALIFYING DESCRIPTORS 56

- Application to Surficial Materials 56
- Application to Geological Processes 57

TYPES OF TERRAIN UNIT SYMBOLS 59

Composite Units 59
Stratigraphic Units 60
Subclass Modifiers 61

ON–SITE SYMBOLS 66

Application of On–Site Symbols 66
List of On–Site Symbols 66

EXAMPLE TERRAIN MAP AND LEGEND 70

BIBLIOGRAPHY 73

APPENDIX I: GLOSSARY OF TERMS 75

APPENDIX II: 81
FIELD DETERMINATION OF TEXTURE FOR SAND, SILT AND CLAY

APPENDIX III: 85
COMPUTER AIDED INTERPRETATION OF TERRAIN (SURFICIAL GEOLOGY) DATA BY "CAPAMP"

APPENDIX IV: 89
A LIST OF EMENDATIONS TO THE 1976 TERRAIN CLASSIFICATION SYSTEM

LIST OF FIGURES

Figure 1. Model of the principal axes of a clast. 3

Figure 2. Particle roundness: two general classes. 3

Figure 3. Textural examples of various materials. 6

Figure 4. Various classification systems for particle size. 9

Figure 5. (a) Talus cones; (b) Fine–textured slump deposit; (c) Angular, bedrock–derived colluvium deposited as a result of rapid mass movement process. 12

Figure 6. Spheroidal weathering of granodiorite. 14

Figure 7. Cross–section through a hummock in kame and kettle topography that shows ice–contact gravels. 16

Figure 8. Fine–textured glaciolacustrine sediments exposed in a terrace. 19

Figure 9. Bedrock slope mantled by till. 20

Figure 10. Steep slope or escarpment comprised of layers of till, glaciofluvial gravel, marine silt and fluvial gravel. 22

Figure 11. A shallow mantle of silt–size volcanic ash overlying rubbly, bedrock–derived colluvium. 23

Figure 12. Raised, linear beach ridges. 24

Figure 13. Block diagram illustrating the difference between steep, moderately steep and moderate slopes. 28

Figure 14. Schematic cross–sections that illustrate and distinguish the surface expression terms blanket and veneer. 28

Figure 15. Schematic cross–sections to illustrate the use of stratigraphic symbols with the surface expression terms blanket and veneer. 29

Figure 16. Block diagrams that illustrate the surface expression terms cone and fan. 30

Figure 17. Examples of the surface expression terms rolling, ridged, undulating and hummocky. 33

Figure 18. Level to very gently sloping active delta deposit. 35

Figure 19. Terraces made up of thick Quaternary sediments. 37

Figure 20. Gullied terrace of glaciolacustrine silt undergoing modification by piping. 42

Figure 21. Gullied till in the Coast Range of British Columbia. 43

Figure 22. An example of a braiding channel at moderate to low flow. 44

Figure 23. An irregularly sinuous channel. 45

Figure 24. The Stikine River in the Coast Mountains, an example of anastamosing channel. 46

Figure 25. A meandering channel. 47

Figure 26. A till and colluvial slope that has been subject to several snow avalanches. 48

Figure 27. Hummocky and irregular topography of lower portion of the Pavilion earthflow — a slow mass movement. 49

Figure 28. Recent debris slides and flows (rapid mass movements) on steep slopes made up of till and colluvium. 50

Figure 29. Patterned ground, evidence of cryoturbation, in till materials. 51

Figure 30. Solifluction lobes in till materials in the alpine zone. 52

Figure 31. Lateral meltwater channels developed on a slope made up of till. 54

Figure 32. Pitted or kettled topography made up sandy gravel glaciofluvial eskers and kames. 55

Figure 33. An example of a stratigraphic unit. 61

Figure 34. Block diagrams illustrating various types of mass movements (modified from Varnes, 1978). 65

Figure 35. Example of a CAPAMP Interpretive Slope Hazard Map. 86

Figure 36. Example of Terrain (Surficial Geology) Form. 87

LIST OF TABLES

Table 1. Relationship between size and roundness of the clastic textural terms. 4

Table 2. Percent ranges for textural descriptions composed of 1 to 3 symbols. 7

Table 3. Subclass modifiers for mass movement processes. 64

INTRODUCTION

The Terrain Classification System is a scheme designed for the classification of surficial materials, landforms and geological processes. It has been specifically developed to provide an inventory of the terrain features in the landscape and to show their distribution, extent and location. The system is scale independent and provides base data applicable for a wide range of natural resource applications including planning, management, impact assessment and research. The data is conveyed in map form by the use of terrain unit symbols and is conducive to computer digital storage, management and processing.

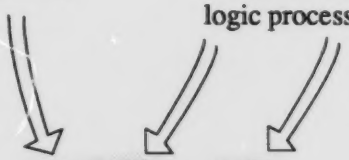
EXAMPLE TERRAIN UNIT SYMBOL

Information is portrayed on a terrain map by a terrain unit symbol which is composed of a group of letters. These letters provide information about the character of the terrain and are arranged in a manner such that each letter position represents a particular characteristic of the terrain. Information provided by a terrain unit symbol includes texture and type of surficial material, surface expression, geologic processes, and qualifying descriptors.

Simple Terrain Unit Symbol

TEXTURE (one to three lower case letters) describes the size, roundness and sorting of particles in mineral sediments and the fibre content of organic materials (see pg. 3–9).

QUALIFYING DESCRIPTORS (up to two superscript upper case letters) are used where appropriate to provide additional information about surficial materials and geologic processes (see pg. 56–58).



$$sgF^{G}t - F^{I}$$

SURFICIAL MATERIAL (one upper case letter) is classified according to its mode of deposition (see pg. 10–25).

GEOLOGICAL PROCESSES (one to three upper case letters) describes geologic processes that are modifying either surficial materials or landforms (see pg. 39–55).

SURFACE EXPRESSION (one to three lower case letters) describes the form (shape) of the land surface or the thickness of the surficial material (see pg. 26–38).

This symbol above indicates a glaciofluvial (F^{G}) terrace (**t**) composed of sandy gravel (**sg**) modified by slow downslope failures (**F**) that are no longer active (^{I}).

Note: Various types of terrain units are discussed in detail on pages 59–65.

TEXTURE OF SURFICIAL MATERIALS

Texture refers to the size, shape and sorting of particles in unconsolidated clastic sediments, and the proportion and degree of decomposition of plant fibre in unconsolidated organic sediments.

Particle size is considered to be the length of the intermediate ("b") axis of a clast (Figure 1). For particles 2mm in size or larger this dimension can be measured by hand. Smaller particle sizes can be estimated in the field by hand texturing (see Appendix II) or measured by laboratory procedures. The proportion of sand particles may be determined in the field by sieving. The Wentworth Grade Scale (in Krumbein and Sloss, 1963, p.96) is the basis of this particle size classification, with the exception that 0.002mm has been adopted as the silt/clay boundary.

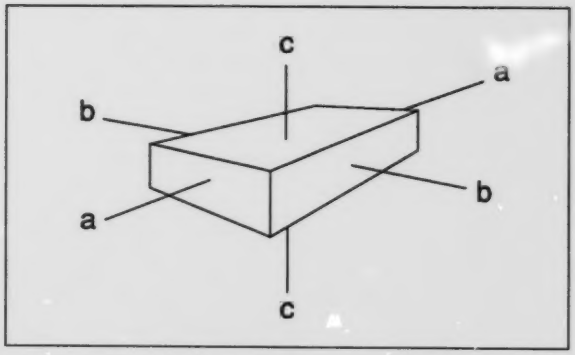


Figure 1. Model of the principal axes of a clast.

Particle shape refers to the degree of roundness of clasts greater than 2mm. Roundness is the degree of rounding or smoothing (c.f. angularity) of the edges and corners (Figure 2).

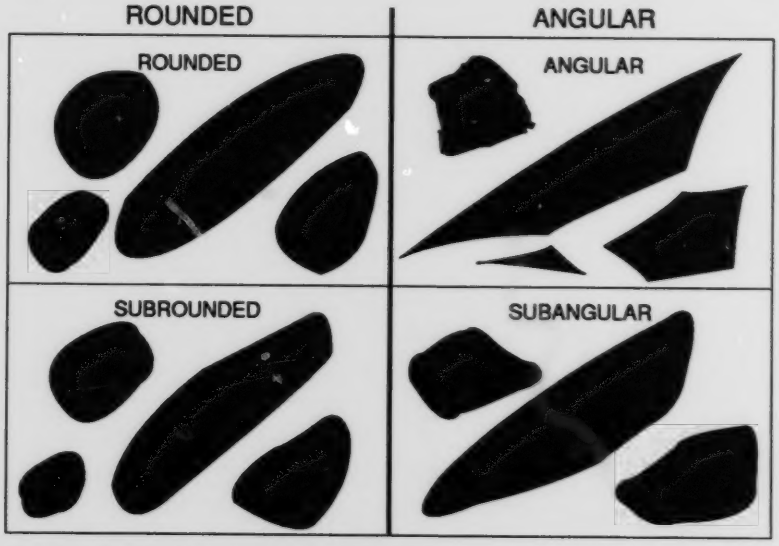


Figure 2. Particle roundness: two general classes are used in terrain mapping (rounded and angular).

The degree of sorting or particle size distribution refers to the range of particle sizes comprising a sediment. A "well–sorted" sediment such as eolian dune sand, consists of a narrow size range, whereas a "poorly–sorted" sediment, such as ice–contact (glaciofluvial) material, encompasses a broad size range.

TEXTURAL TERMS AND SYMBOLS

Specific Clastic Terms		*Common Clastic Terms*		*Organic Terms*	
Name	Map Symbol	Name	Map Symbol	Name	Map Symbol
blocks	**a**	mixed fragments	**d**	fibric	**e**
boulders	**b**	angular fragments	**x**	mesic	**u**
cobbles	**k**	gravel	**g**	humic	**h**
pebbles	**p**	rubble	**r**		
sand	**s**	mud	**m**		
silt	**ɨ**	shells	**y**		
clay	**c**				

DEFINITION OF TEXTURAL TERMS

The definition of the specific and common clastic, and organic texture terms are provided below. Table 1 illustrates the relationship of size and roundness in the textural classification of the clastic sediments; example textures are presented in Figure 3.

	roundness \ size mm	256	64	2	.062	.002
specific	rounded	boulder **b**	cobble **k**	pebble **p**		
	rounded/ angular			sand **s**	silt **ɨ**	clay **c**
	angular	block **a**				
common	rounded		gravel **g**			
	rounded/ angular		mixed fragments **d**		mud **m**	
	angular		rubble **r**			
			angular fragments **x**			

Other: Shells — dominantly whole and broken shell fragments.

Table 1: Relationship of size and roundness of the clastic textural terms

Specific Clastic Terms

Specific clastic textures have a narrow size range and an implication of clast shape (e.g. rounded versus angular) for particles greater than 2mm in size.

Name	*Definition*
blocks	Angular particles greater than 256mm in size.
boulders	Rounded particles greater than 256mm in size.
cobbles	Rounded particles between 64 and 256mm in size.
pebbles	Rounded particles between 2 and 64mm in size.
sand	Particles between .0625 and 2mm in size.
silt	Particles between 2μm and .0625mm in size.
clay	Particles less than 2μm in size.

Common Clastic Terms

Common clastic terms refers to a grouping of specific clastic size ranges and, in some cases, an indication of clast shape.

Name	*Definition*
mixed fragments	A mixture of rounded and angular particles greater than 2mm in size.
angular fragments	A mixture of angular fragments greater than 2mm in size (e.g. a mixture of blocks and rubble).
gravels	A mixture of two or more size ranges of rounded particles greater than 2mm in size (e.g. a mixture of boulders, cobbles and pebbles), and may include interstitial sand.
rubble	Angular particles between 2 and 256mm (and may include interstitial sand). Note: In general, little or no fine material will be visible on a rubble surface. At depth, sand, silt and clay particles may occupy the interstices between the coarser particles.
mud	A mixture of silt and clay; may also contain a minor fraction of fine sand.
shells	A sediment comprised dominantly of shells and/or shell fragments of variable sizes.

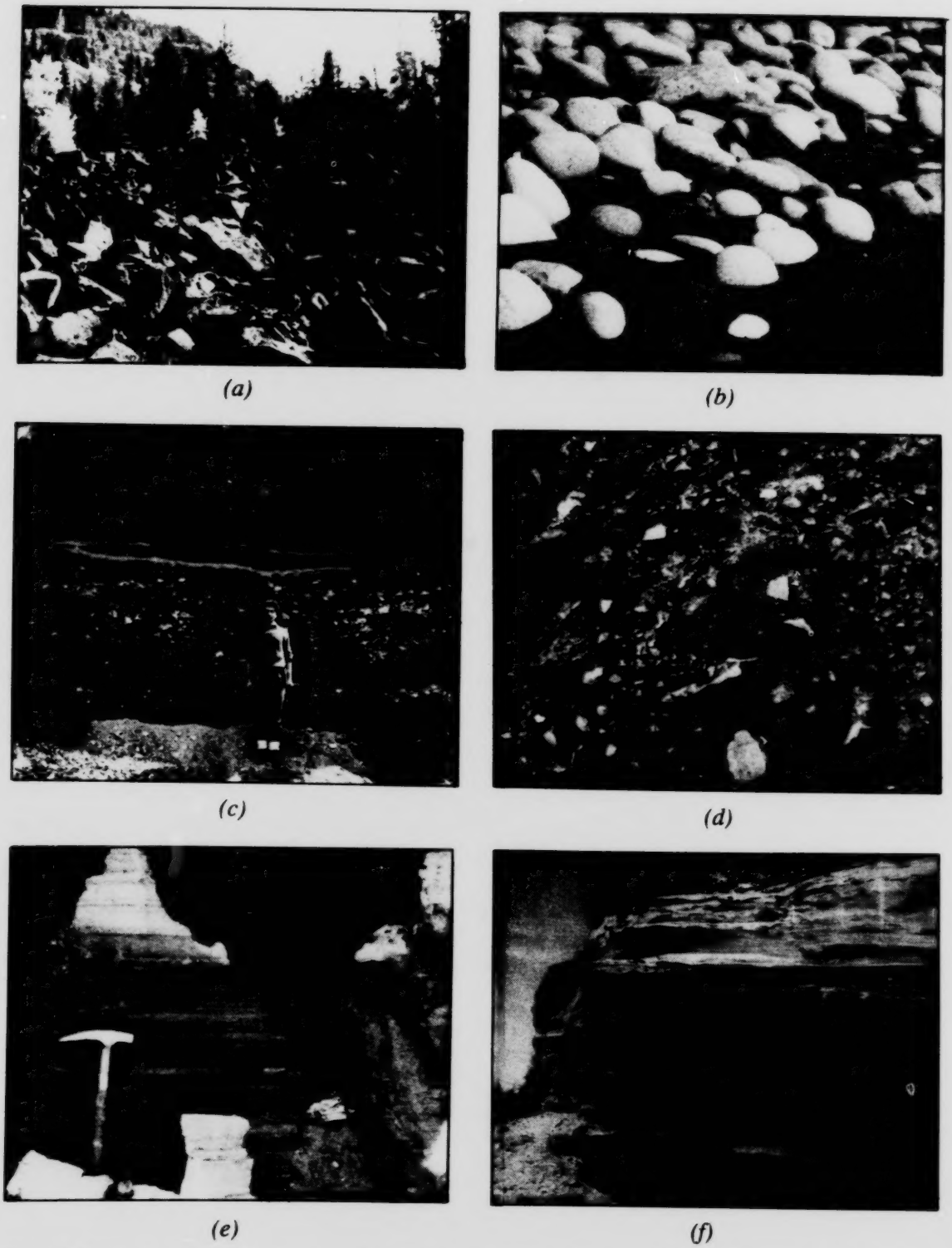


Figure 3. Textural examples of various materials: (a) angular blocks of a colluvial talus deposit, (b) rounded boulders on an active beach, (c) bedded fluvial gravels with some beds of sand, (d) till made up of rounded and angular particles (mixed fragments) in a silty sand matrix, (e) marine sediments made up of clayey silt and (f) bedded glaciofluvial sands.

Organic Terms*

Organic terms are based on the proportion and degree of decomposition of the organic materials.

Name	*Definition*
fibric	The least decomposed of all organic materials. It contains amounts of well–preserved fibre (40% or more) that can be identified as to botanical origin upon rubbing.
mesic	Organic material is at a stage of decomposition intermediate between fibric and humic.
humic	Organic material is at an advanced stage of decomposition; it has the lowest amount of fibre, the highest bulk density, and the lowest saturated water–holding capacity of the organic materials; fibres that remain after rubbing constitute less than 10% of the volume of the material.

Note: Rubbed fibre is the fibre that remains after rubbing a sample about 10 times between the thumb and forefinger.

* See Canada Soil Survey Committee (1978) for full definitions.

APPLICATION OF TEXTURAL TERMS

- Up to three textural terms can be used to describe the texture of a surficial material; textural term symbols are placed before the surficial material symbol; where two or three textural symbols are used they are listed in reverse order of importance so that the symbology may be easily verbalized; a textural component will not generally be shown if it constitutes less than 20% of the total volume of the deposit. Table 2 shows the corresponding range in percent amount of each texture class when 1 to 3 textural terms are used.

Number of Symbols	*Example*	*Subordinate 2*	*Subordinate 1*	*Dominant*
1	s (sand)	—	—	80 – 100 (sand)
2	gs (gravelly sand)	—	20 – 49 (gravel)	41 – 80 (sand)
3	bgs* (bouldery gravelly sand)	20 – 32 (boulder)	21 – 39 (gravel*)	28 – 59 (sand)

* Note: In this example the gravel term donates those size ranges as defined by gravel excluding the boulder texture class (see pg. 8).

Table 2: Percent ranges for texture descriptions comprised of 1 to 3 symbols.

- The three–fold textural description may be made up of any combination of specific clastic, common clastic, and organic class textural terms. Note: See organic surficial material definition for criteria used to distinguish clastic and organic sediments (see pg. 21).

- Using two or three textural terms together, indicates that either the various textures are intermixed or they are interstratified (Example A). Discrete areas of different textured materials are indicated by a composite unit symbol (Example B).

  Example A: ⸗sL — indicates that the lacustrine material consists of a uniform silty sand, or interlayered beds of silt and sand;

  Example B: ⸗L/sL — indicates occurrence of discrete areas of silt and sand in the terrain unit.

- Where specific and common clastic textural terms are used together, the common term will denote two or more size ranges not accommodated by the specific term.

  Example: bgF — indicates the common texture class gravel (g) describing the fluvial material does not include the specific texture class boulder (b); it is comprised only of the specific texture classes of cobble and pebble.

- The omission of textural terms from a terrain unit description implies that the texture of the surficial material lies somewhere within the range of textures defined for the surficial material. Lack of a texture symbol indicates the mapper had insufficient knowledge to be more specific.

GENERAL USE OF TEXTURAL TERMS

Mappers should be aware the texture of surficial materials can vary both laterally and vertically within a terrain unit. Thus, a texture based on a field observation or laboratory analysis from one site may not necessarily represent the texture for the entire terrain unit.

Mappers can imply the degree of sorting of a surficial material through the use of single or multiple specific or common clastic texture terms. A well–sorted material will generally be described by a single specific textural term. For example, the texture of a well–sorted eolian sand dune would be indicated by the specific texture symbol "s". Poorly — or less sorted materials, on the other hand, will be described by the use of two or three specific and/or common textural terms. For example, three textural terms such as "⸗sd" could describe a poorly–sorted till comprised of mixed rounded and angular fragments greater than 2mm with a lesser amount of sand and silt. Occasionally, for specific purposes, mappers may find it necessary to use a specialized texture classification such as the Unified texture classification (The Asphalt Institute, 1978) or some other system. Some existing textural classification schemes are shown in Figure 4. Any such modifications should be fully documented in the attached map legend.

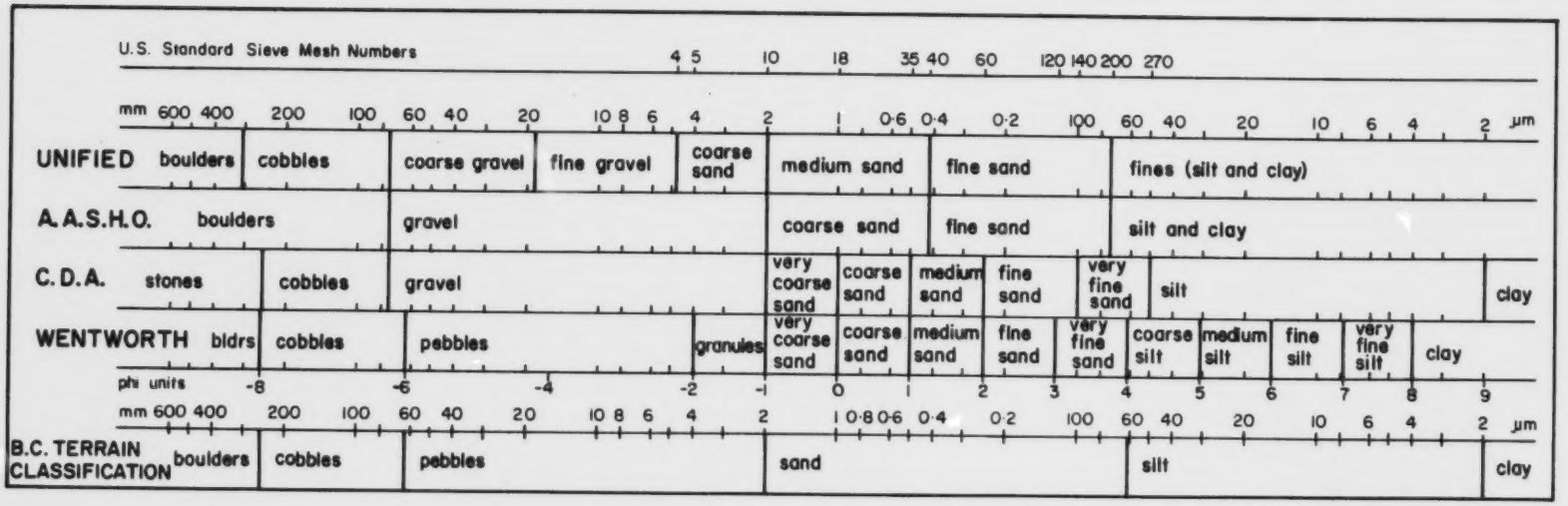


Figure 4. Various classification systems for particle size.

SURFICIAL (GENETIC) MATERIALS

Surficial materials are defined as non–lithified, unconsolidated sediments occurring on the earth's surface. They are materials produced by weathering, biological accumulation, man and volcanic activity. They include residual materials weathered from rock in situ; transported materials composed of mineral, rock and organic fragments deposited by water, wind, ice, gravity, or any combination of these agents; accumulated materials of biological origin including man–made deposits; and unconsolidated pyroclastic sediments.

In general, surficial materials are of relatively young geological age and they constitute the parent material of most (pedological) soils. Other terms that are virtually synonymous with "surficial material" are the "Quaternary sediments" and "unconsolidated materials" of the geologist and the "soil" and "earth" of the engineer. Surficial materials are classified according to their mode of formation. Specific processes of erosion, transportation, deposition, mass wasting and weathering produce materials that have specific sets of physical characteristics. This is the single most useful descriptor of surficial materials.

Surficial materials are also described by the status of their formative process. ***Each surficial material has an assumed status of activity*** The status is either active or inactive, and is indicated by a qualifying descriptor symbol through the use of the superscripts "I" (inactive) or "A" (active). Status of activity is indicated only when the actual state of formation is contrary to the assumed state defined for each material. Surficial materials displaying direct evidence that glacier ice exerted a strong, but secondary or indirect control, upon their mode of origin are indicated by a qualifying descriptor symbol, superscript "G". For further details see "Qualifying Descriptors", pages 56–58.

SURFICIAL MATERIAL TERMS AND SYMBOLS

Material Name	*Map Symbol*	*Assumed Status of Formative Process*
Anthropogenic	A	active
Colluvial	C	active
Weathered Bedrock (in situ)	D	active
Eolian	E	inactive
Fluvial	F	inactive
Glaciofluvial	F^G	inactive
Ice	I	active
Lacustrine	L	inactive
Glaciolacustrine	L^G	inactive
Morainal (Till)	M	inactive
Organic	O	active
Bedrock	R	–
Undifferentiated	U	–
Volcanic	V	inactive
Marine	W	inactive
Glaciomarine	W^G	inactive

DEFINITION OF SURFICIAL MATERIAL TERMS

ANTHROPOGENIC — Map Symbol: A — Status: active

Man–made materials or man–modified geological materials such that their initial physical properties (e.g. structure, cohesion, compaction) have been drastically altered.

General Description: Anthropogenic materials commonly have a wide range of textures. They are typically formed by the removal of material from an original site followed by deposition elsewhere. Also included are areas where topography and/or surface materials have been extensively changed due to removal of rock or unconsolidated deposits. These deposits are commonly associated with mineral exploitation, waste disposal and archaeological sites.

Application and Examples:

- Applied to man–made deposits such as landfills, spoil heaps, tailings, and artificial islands; also used to describe excavation areas such as open–pit mines.

- Applied to archaeological sites such as middens and historical whale rendering sites.

  Example: a historic shelly midden deposit — $yA^{I}t$

- On–site symbols for sites are defined for use where area of disturbance is too small to be mapped (pg. 69).

- Anthropogenic is not applied to urban areas where development has not masked the in situ material.

COLLUVIAL — Map Symbol: C — Status: active

Materials that have reached their present positions as a result of direct, gravity–induced movement involving no agent of transportation such as water or ice, although the moving material may have contained water and/or ice.

General Description: Generally consist of massive to moderately well–stratified, non–sorted to poorly–sorted sediments with any range of particle sizes from clay to boulders and blocks. The character of any particular colluvial deposit depends upon the nature of the material from which it was derived and the specific mass wastage process whereby it was deposited.

Application and Examples:

- Applied to unconsolidated materials that originate by disintegration of rock and have been moved by gravity. These include deposits of local, bedrock–derived colluvial mantles, and deposits from specific mass wastage processes (see below). In general, these deposits are rubbly to blocky in texture and relatively easily identified (Figure 5).

Example: colluvial veneer derived from and overlying bedrock — $\frac{rCv}{Rk}$

- Mantles of colluvial veneers and blankets derived from, and overlying other unconsolidated Quaternary sediments are only mapped as colluvium if they are significantly dissimilar to the underlying material.

Example: colluvium derived from till overlying fluvial gravels — $\frac{mdCv}{gF}$

Example: weathered mantle of till overlying unweathered till — Mb

(a)

(b)

(c)

*Figure 5. (a) Talus cones (map symbol: **rCc-R**) derived from the steep bedrock outcrops by rapid mass movement and gully processes (map symbol: **Rs-RV**) (location of photo: Keremeos). (b) Fine-textured slump deposit (map symbol: **fL^{G}th**) derived from glaciolacustrine silts (location of photo: Spence's Bridge). (c) Angular, bedrock-derived colluvium deposited as a result of rapid mass movement processes in the form of a colluvial fan (map symbol: **srCf-R**) (location of photo: Port Alice, Vancouver Island).*

- Clastic and/or organic deposits resulting from snow avalanches, or mass movements including landslides, rockfalls, earthflows or debris–flows, are mapped as colluvium. These deposits typically occur as fans, cones, hummocks or irregular topography (Figure 5).

Example:	talus slope	rCa
Example:	debris–flow fan	mdCf
Example:	slump–earthflow derived from glaciolacustrine silts	ɀChu

- Colluvium is considered to be a product of an active process unless there is evidence to the contrary. Most mass movement processes tend to be continuous or repetitive over time. Thus, it may be unwise to indicate a process has definitely ceased to occur. The map symbol "C^1" should only be used with great caution.

WEATHERED BEDROCK Map symbol: **D** Status: **active**

Bedrock decomposed in situ by processes of mechanical and/or chemical weathering.

General Description: The character of weathered bedrock debris depends on the process of formation and the type of bedrock. Debris produced by mechanical weathering typically consists of angular fragments, although plutonic rock fragments may be converted in situ to subrounded forms by spheroidal weathering. In contrast, bedrock that has been altered by chemical weathering usually contains a high proportion of residual silts and clays.

Application and Examples:

- Applied only to rock that has been sufficiently weathered such that properties related to its strength are significantly different from those of the equivalent unweathered rock.

- Applied to weathered bedrock that has not been subject to downslope movement due to gravity. Weathered bedrock may be distinguished from colluvium on gently sloping surfaces by the absence of features that result from downslope movement such as solifluction lobes, stone stripes and boulder streams.

- Includes blockfields, grus, and saprolite (Figure 6).

Example:	blockfield	aDb
Example:	weathered shale (in situ)	ɀD

- Blockfields too small to form a terrain unit may be indicated by an on–site symbol (pg. 67).

*Figure 6. Spheroidal weathering of granodiorite produced this level grus–covered area; these areas do not exhibit active slope processes and are mapped as weathered bedrock (map symbol: **sDv**). (location of photo: Okanagan Range, southeast British Columbia).*

EOLIAN Map symbol: **E** Status: **inactive**

Materials transported and deposited by wind action.

General Description: Generally consists of medium to fine sand and coarse silt that is well–sorted, non–compacted (loose), and may contain internal structures such as cross–bedding or ripple laminae, or may be massive. Individual grains may be rounded and exhibit frosting.

Application and Examples:

- Includes loess, dunes, and shallow mantles of sand and coarse silt.

  Example: veneer of sandy silt on a river terrace $\frac{s\text{-}Ev}{Ft}$

  Example: active sand dune $sE^{\wedge}r$

- Inactive or active dunes too small to be mapped may be indicated by an on–site symbol (pg. 68).

FLUVIAL — Map symbol: F — Status: inactive

Materials transported and deposited by streams and rivers; synonymous with alluvial.

General Description: Deposits generally consist of gravel and/or sand, and/or silt (and rarely, clay). Gravels are typically rounded and contain interstitial sand. Fluvial sediments are commonly moderately– to well–sorted, and display stratification, although massive, non–sorted fluvial deposits do occur.

Application and Examples:

- Applied to materials associated with floodplains, fluvial terraces and fans, and deltas.

- Floodplain deposits include channel deposits of relatively coarse gravel with weak to prominent stratification, and flood deposits (overbank sediments and levees) that may cover extensive areas away from the main channel and are composed of relatively finer sediments (commonly silt and sand).

  Example: floodplain consisting of channel gravels overlain by overbank silt and sand — $\frac{\text{sF}^{\text{A}}\text{v}}{\text{gFp}}$

- Fluvial terrace deposits consist of channel deposits that may include some overbank materials.

  Example: an inactive fluvial terrace composed of stratified sand and gravel — sgFt

- Fluvial materials that are likely to be affected by inundation or channel processes are considered to be active. This is indicated by the "active" process qualifying descriptor denoted by the superscript "A" (see pg. 56–57).

  Example: active floodplain made up of pebble sized gravel in sands — $\text{psF}^{\text{A}}\text{p}$

- Fans consisting of interbedded fluvial and colluvial sediments should be mapped as either fluvial "F" or colluvial "C" depending upon which type of material or process appears to be dominant.

- Deltas are mapped as fluvial materials because most delta surfaces are essentially the result of fluvial processes.

GLACIOFLUVIAL Map Symbol: F^G Status: **inactive**

Materials that exhibit clear evidence of having been deposited by glacial meltwater streams either directly in front of, or in contact with, glacier ice.

General Description: Glaciofluvial materials typically range from non–sorted and non–bedded gravel made up of a wide range of particle sizes, such as that resulting from very rapid aggradation at an ice front, to moderately– to well–sorted, stratified gravel; flow tills may occur in some deposits. Slump structures and/or their equivalent topographic expression, such as hummocky or irregular terrain may be present. These features are indicative of collapse of the material due to melting of supporting ice. Kettles may occur on the surface of these deposits; they result from the melting of buried or partially buried ice.

Application and Examples:

- It is applied to materials that make up kettle or pitted outwash, kames and kame terraces, delta kames, eskers, and kame and kettle topography (Figure 7).

Examples:	kettled or pitted sandy gravel outwash plain	sgF^Gp-H
	eolian veneer of sandy silt overlying a gravel kame terrace	$\frac{sEv}{gF^Gt}$

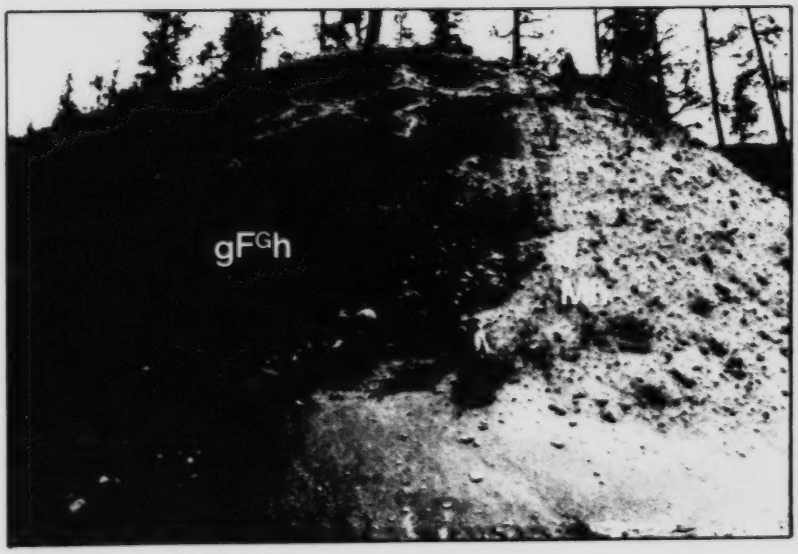


Figure 7. Cross–section through a hummock in kame and kettle topography that shows ice–contact gravels (map symbol: gF^Gh) (note: slump structures and rapid textural variations) and till (map symbol: Mh).

- Outwash deposits, such as plains and terraces displaying none of the ice contact features described above (e.g. kettles) may be mapped as glaciofluvial deposits if reconstruction of the geological history indicates a glacial source; otherwise, these deposits are mapped as fluvial deposits by the surficial material term "F".

- Eskers and kettles too small to be mapped can be indicated by on–site symbols (pg. 67). Other glacial features which may be associated with glaciofluvial deposits and for which on–site symbols are available, are listed on pages 66–68.

ICE — Map Symbol: I — Status: active

Areas of snow and ice where evidence of active glacier movement is present.

Application and Examples:

- Glacier movement is indicated by features such as crevasses, supraglacial moraines, icefalls and ogives.

- Applied to all types of glaciers and associated permanent snowfields such as cirque glaciers, mountain icefields, and valley and piedmont glaciers.

Examples:	a valley glacier overlain by coarse, angular ablation moraine	$\frac{\text{arMb}}{\text{I}}$
	an icefield with rock nunatuks	I//Rs

LACUSTRINE — Map Symbol: L — Status: inactive

Sediments that have settled from suspension, and occasionally by underwater gravity flows, such as turbidity currents, in bodies of standing fresh water, or sediments that have accumulated at their margins through the action of waves.

General Description: Sediments commonly consist of stratified fine sand, silt and/or clay deposited on the lake bed from suspension, or moderately– to well–sorted, stratified sand and coarser materials that are beach and other littoral sediments transported and deposited by wave action.

Application and Examples:

- Applied to Holocene lake basins that have either drained or infilled, and active or "raised" (inactive) shoreline deposits.

Examples:	drained lake floor	ɨLp

	modern beach along a lakeshore	$sgL^{A}j$
	"raised" beach ridge	gL_{r}

- May be applied to intermittently exposed sediments on the floors of seasonal lakes.

Example:	floor of shallow lake periodically inundated	$\not L^{A}p$-U

- Deltas are mapped as either fluvial or glaciofluvial materials (see pg. 15–16).
- Raised shorelines too small to be mapped can be illustrated by the strandline on–site symbol (pg. 68).
- Lacustrine materials of limited extent or overlain by younger surficial materials may be indicated by the on–site stratigraphic symbol (see pg. 69). This is particularly useful because of the lacustrine materials potential effects on slope stability and groundwater movement.

GLACIOLACUSTRINE Map Symbol: L^{G} Status: **inactive**

Lacustrine materials deposited in or along the margins of glacial (ice–dammed) lakes; includes sediments that were released by the melting of floating ice.

General Description: Glaciolacustrine sediments include: 1) lake bed sediments consisting of stratified fine sand, silt and/or clay; they commonly contain ice–rafted stones and lenses of till and/or glaciofluvial material; slump structures and/or their equivalent topographic expression, such as hummocky or irregular terrain may be present and are indicative of collapse of the material due to melting of supporting ice; kettles may occur on the surface of these deposits, the result of the melting of buried or partially buried ice, and 2) moderately–sorted to well–sorted, stratified sand and coarser beach sediments transported and deposited by wave action along the margins of glacial lakes.

Application and Examples:

- Applied to lake sediments that display ice–contact features such as kettles, slump structures, and the inclusion of ice–rafted stones and other materials (Figure 8).

Examples:	Pitted or kettled terrace made up of glaciolacustrine silt	$\not L^{G}t$-H
	Escarpment composed of glaciolacustrine sand overlain by till	$\frac{Ms}{sL^{G}s}$

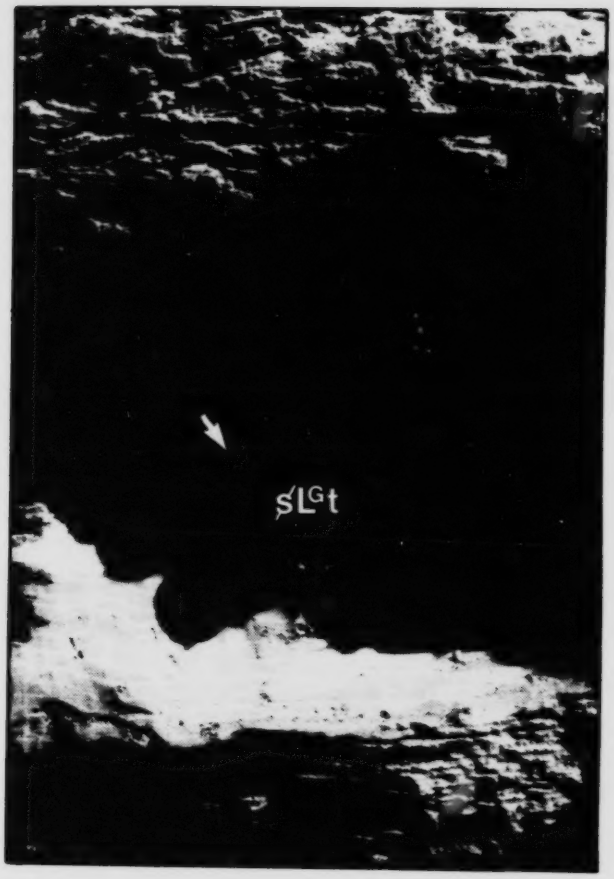


Figure 8. Fine–textured glaciolacustrine sediments exposed in a terrace; note the drop stone (arrow) and contorted bedding (map symbol: sLGt) (location of photo: Gold River, Vancouver Island).

- Most lacustrine sediments in British Columbia, that lie at elevations above present valley floors were deposited in glacial lakes that have subsequently drained. If reconstruction of the former lake (elevation, extent and outlet location) indicates it was ice–dammed or blocked by other means peculiar to deglaciation, the deposits are mapped as glaciolacustrine "L^G" in origin. Otherwise, the deposit is mapped as lacustrine using the surficial material symbol "L".

- Relict shoreline deposits may be mapped by the strandline on–site symbol; glaciolacustrine materials of limited extent or overlain by younger surficial materials may be indicated by the on–site stratigraphic symbol (see pg. 69). This is particularly useful because of the glaciolacustrine materials potential effects on slope stability and groundwater movement. Other glacial features which may be associated with glaciolacustrine deposits and for which on–site symbols are available, are listed on pages 66–68.

MORAINE (TILL) **Map symbol: M** **Status: inactive**

Material deposited directly by glacier ice without modification by any other agent of transportation.

General Description: Morainal material can be transported beneath, beside, on, within and in front of a glacier. The mineralogical, textural, structural and topographic characteristics of till deposits are highly variable and depend upon both the source material incorporated by the glacier and the mode of formation (genesis). In general, till deposits consist of well–compacted to non–compacted material that is non–stratified and contains a heterogeneous mixture of particle sizes, often in a matrix of sand, silt and clay.

Application and Examples:

- Applied to all varieties of till, including basal till (ground moraine), lateral and terminal moraines, moraines of cirque glaciers, hummocky ice–disintigration moraine, Neoglacial (recent) moraines and pre–existing unconsolidated sediments reworked by a glacier so that their original character (not necessarily texture) is largely or completely destroyed (Figure 9).

Examples:	rolling, undulating till plain	mdMm
	moraine ridge at terminus of modern glacier	xM^r
	hummocky ice–disintigration moraine	ɨsgMh

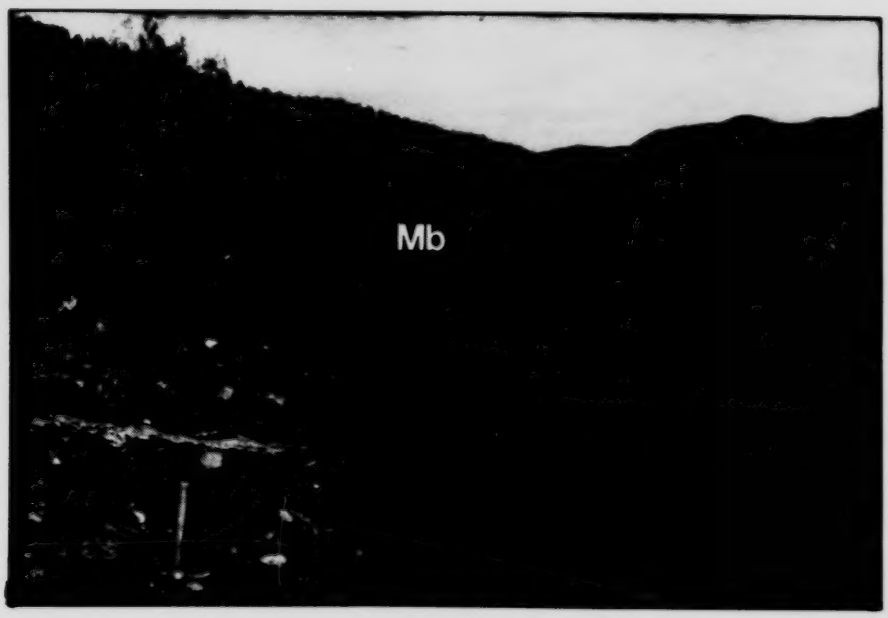


*Figure 9. Bedrock slope mantled by till that is of uniform thickness greater than 1 metre (map symbol: **Mb**) and cross–section of a basal till (inset) illustrating a typical till texture made up of rock fragments of many sizes and shapes in a matrix of sand, silt and clay (location of photo: Ashnola River Valley).*

- On–site symbols are available for a number of specific features which occur in morainal deposits and for morainal deposits of limited extent, including drumlins, crag and tail, moraine ridges (minor and major), and undifferentiated lineations and flutings (see pg. 66–67). Other glacial features which may be associated with morainal deposits, for which on–site symbols are available, are listed on pages 66–68.

ORGANIC

Map Symbol: **O** Status: **active**

Sediments composed largely of organic materials resulting from the accumulation of vegetative matter. They contain at least 30% organic matter by weight (17% or more organic carbon).

General Description: Two types of organic sediments are recognized. The first are commonly saturated with water and consist mainly of the accumulated remains of mosses, sedges, or other hydrophytic vegetation. The second are rarely saturated with water and consist typically of leaf litter, twigs, branches and mosses.

Application and Examples:

- Commonly saturated organic sediments include those deposits in bogs, fens and swamps.

Examples:	thick, level peat bog	fOp
	swamp muck overlying silty clay lacustrine	$\frac{\text{mhOv}}{\text{tcLp}}$

- Rarely saturated organic sediments include those forest floor accumulations (duff) which directly overlie bedrock (defined below). Note: *Duff or forest floor organic sediments overlying unconsolidated deposits are not recognized as organic deposits.*

Examples:	thin (but more than 10 cm) layer of forest litter overlying undulating bedrock	$\frac{\text{fOv}}{\text{Ru}}$
	thick layer of forest litter overlying a gravelly sandy fluvial fan *(litter layer not mapped)*	gsFf

BEDROCK

Map Symbol: **R** Status: **not applicable**

Bedrock outcrops and rock covered by a thin mantle (up to 10cm thick) of unconsolidated or organic materials.

Application and Examples:

- Texture symbols are not used to describe bedrock.

- Surface expression should be described for bedrock, especially when the bedrock is not overlain by unconsolidated deposits, or if it influences the surface expression of overlying unconsolidated deposits.

Example:	steep rock scarp	Rs
	till mantle (less than 1 metre thick) overlying hummocky bedrock	Mv / Rh

- Bedrock escarpments of limited extent can be shown using the appropriate on–site symbol (see pg. 68).

UNDIFFERENTIATED Map symbol: **U** Status: **not applicable**

A layered sequence of more than three types of surficial material outcropping on a steep, erosional (scarp) slope.

Application and Examples:

- Applied to steep slopes where linear bands (in plan view) of different materials are so closely juxtaposed that they cannot be delimited separately at the scale of mapping (Figure 10).

Example:	scarp slope consisting of a layered sequence of several materials	Us

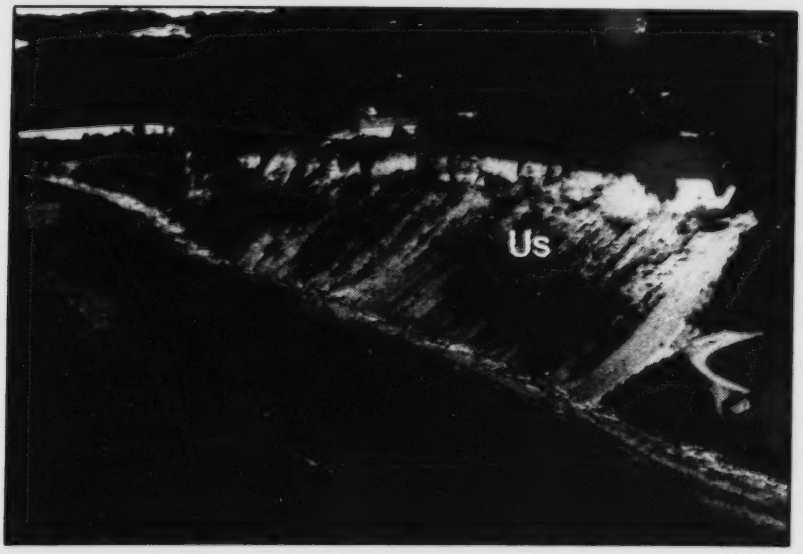


Figure 10. Steep slope or escarpment comprised of layers of till, glaciofluvial gravel, marine silt and fluvial gravel is mapped as "Us" (location of photo: Cowichan Head, Victoria).

- Texture symbols are not used to describe undifferentiated deposits.

- The symbol "U" may be used as part of a composite unit where a mapper judges it is necessary to indicate the presence of a specific member of the undifferentiated group.

  Example: as above, but the mapper wishes to indicate the presence of the glaciolacustrine silt and clay — Us/$cL^{G}s$

- The stratigraphic sequence that is represented by the symbol "U" may be indicated using the stratigraphic on–site symbo (see pg. 69).

VOLCANIC — Map Symbol: V — Status: Inactive

Unconsolidated pyroclastic sediments.

General Description: Volcanic sediments comprised of ash, cinder lapilli and/or volcanic bombs and blocks.

Application and Examples:

- Generally applied to tephra (volcanic ash) and cinder deposits (Figure 11).

  Example: thick, sand–textured tephra over till — $\frac{sVb}{Mu}$

- In British Columbia, thin layers of volcanic ash buried by younger, non–volcanic sediments are generally less than 10 cm thick, and are not considered mappable units. If necessary, they can be shown by an on–site stratigraphic symbol (see pg. 69). Cinder cones of limited extent may be shown using the appropriate on–site symbol (see pg. 68).

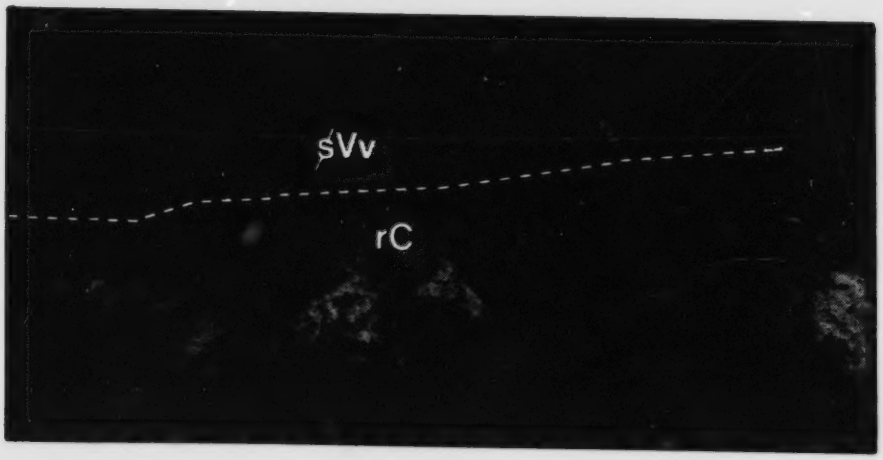


Figure 11. A shallow mantle of silt–size volcanic ash overlying rubbly, bedrock–derived colluvium (map symbol: $\frac{sVv}{rC}$) (location of photo: Bridge River near Lillooet).

MARINE Map Symbol: **W** Status: **inactive**

Sediments deposited in salt or brackish water bodies by settling from suspension and submarine gravity flows, or that have accumulated at their margins through shoreline processes such as wave action and longshore drift.

General Description: Marine sediments deposited offshore generally consist of clay, silt, and sand, that is well– to moderately well–sorted, and well–stratified to massive. Littoral marine sediments consist of well–sorted and well–rounded gravels and sand. Both sediments may contain shells, and the remains of other marine organisms.

Application and Examples:

- Applied to all post–glacial marine sediments including present active shoreline deposits, and offshore and relict shoreline deposits which may have been elevated several tens of metres above present sea level due to isostatic or tectonic uplift (Figure 12).

Examples:	modern beach	gW^j
	elevated marine clay plain	cWp
	raised gravel beach overlying till	$\frac{gWr}{Mj}$

- Marine and lacustrine sediments have many characteristics in common; deposits may be judged to be marine if they are located in an area that might reasonably have contained salt water at the time that the materials were formed. Shells or shell casts of marine origin may occur in these sediments; although their presence indicates marine origin, their absence cannot be interpreted to the contrary.

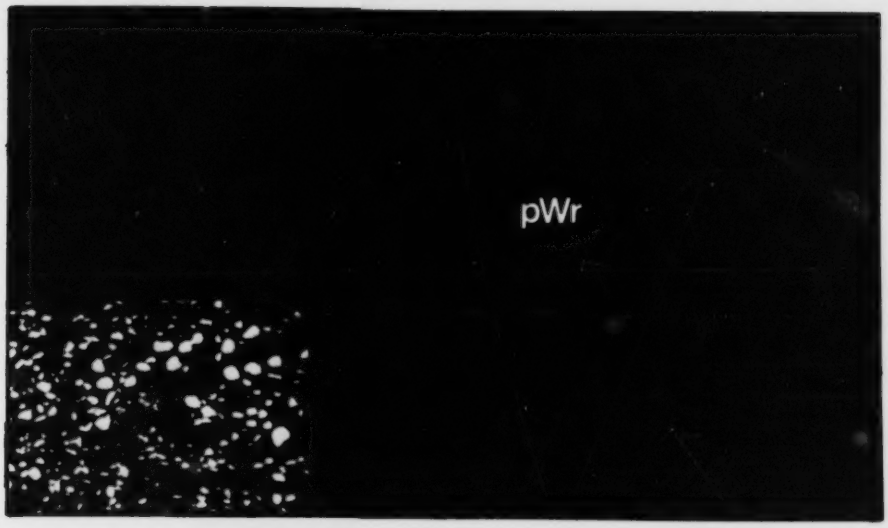


Figure 12. Raised, linear beach ridges made up of well–rounded pebble gravels (inset) with interstitial sand (map symbol: pWr) (location of photo: Queen Charlotte Islands).

- Deltas are mapped as fluvial materials not marine sediments.

- Relict shoreline deposits can be indicated by the strandline on–site symbol; marine materials of limited extent or overlain by younger surficial materials may be indicated by the on–site stratigraphic symbol (see pg. 69). This is particularly useful because of the potential effects of marine materials on slope stability and groundwater movement.

GLACIOMARINE

Map Symbol: W^G Status: **inactive**

Sediments of glacial origin laid down from suspension in a marine environment in close proximity to glacier ice. They include materials originating from submarine gravity flows and settled particles released from melting of both floating ice and ice shelves.

General Description: Glaciomarine sediments range from massive to stratified, well–sorted sand, silt and/or clay. They commonly contain ice–rafted stones and lenses of till and/or glaciofluvial material, till–like diamictons, and stoney clays. Abrupt changes in texture and distorted bedding are common. Marine shells, shell casts and the remains of other marine organisms may be present in the sediment.

Application and Examples:

- Applied to marine sediments that display abrupt textural changes, slump or collapse structures, and/or ice–rafted stones and other materials.

Examples:	a silty clay marine plain with scattered boulders	$_{sc}W^Gp$
	raised outwash marine terrace	$_{sg}W^Gt$

- In British Columbia, most of the marine sediments that lie at elevations above present sea level were deposited during deglaciation. If reconstruction of the local late–glacial history indicates the sediment was deposited in close proximity to glacier or floating ice, the deposits are mapped as glaciomarine "W^G" in origin. Otherwise, the deposits are mapped as marine using the surfical material symbol "W".

- Relict shoreline deposits may be mapped by the strandline on–site symbol; glaciomarine materials of limited extent or overlain by younger surficial materials may be indicated by the on–site stratigraphic symbol (see pg. 69). This is particularly useful because of the potential effects of glaciomarine materials on slope slope stability and groundwater movement. Other glacial features which may be associated with glaciomarine deposits and for which on–site symbols are available, are listed on pages 66–68.

SURFACE EXPRESSION

Surface expression refers to the form (assemblage of slopes) and pattern of forms expressed by a surficial material at the land surface. This three–dimensional shape of the material is equivalent to "landform" used in a non–genetic sense (e.g. ridges, plain). Surface expression symbols also describe the manner in which unconsolidated surficial materials relate to the underlying unit (e.g. veneer).

It is assumed that a terrain map will be presented on topographic base map. The function of the surface expression terms is to augment and highlight the information provided by the topographic base map. They may describe features that are not evident from the contours of the map or highlight the topographic information where necessary. It is recommended that data provided by the topographic contours (e.g. slope angle and configuration) be included on a terrain map presented on a planimetric base map or for a terrain map stored on computer databases (e.g. CAPAMP).

The surface expression of surficial materials is classified according to slope, geometric shape and spatial pattern. The surface expression terms have no genetic implication.

SURFACE EXPRESSION TERMS AND SYMBOLS

Surface Expression Name	*Map Symbol*
moderate slope	**a**
blanket	**b**
cone(s)	**c**
depression(s)	**d**
fan(s)	**f**
hummock(s)	**h**
gentle slope	**j**
moderately steep slope	**k**
rolling	**m**
plain	**p**
ridge(s)	**r**
steep slope	**s**
terrace(s)	**t**
undulating	**u**
veneer	**v**

APPLICATION OF SURFACE EXPRESSION

- Up to three surface expression terms may be used to describe the surface expression of a surficial material and are placed immediately after the surficial material symbol.
- The use of two or three surface expression terms together implies that there is a mixing or juxtaposition of discrete forms and not a combination of intermediate forms.
- When more than one surface expression term is used, the symbols are written in order of decreasing importance based on their areal extent.
- Form, as applied to unconsolidated deposits, refers to the product of the initial mode of origin of the materials.

DEFINITION OF SURFACE EXPRESSION TERMS

MODERATE SLOPE Map Symbol: **a**

An unidirectional (planar) surface with a slope gradient greater than 15°, to and including 26° (26 to 50%), and a smooth, longitudinal profile that is either straight, concave or convex; local surface irregularities generally have a relief of less than 1 metre.

Application and Examples:

- Does not include the surface expression cone (see CONE below).
- Applied to simple, foreset slope of deltas, inclined bedrock or any materials meeting the above definition (Figure 13).

Examples:	colluvial veneer overlying moderately sloping smooth bedrock	$\frac{rCv}{Ra}$
	foreset slope of a delta	sgFa

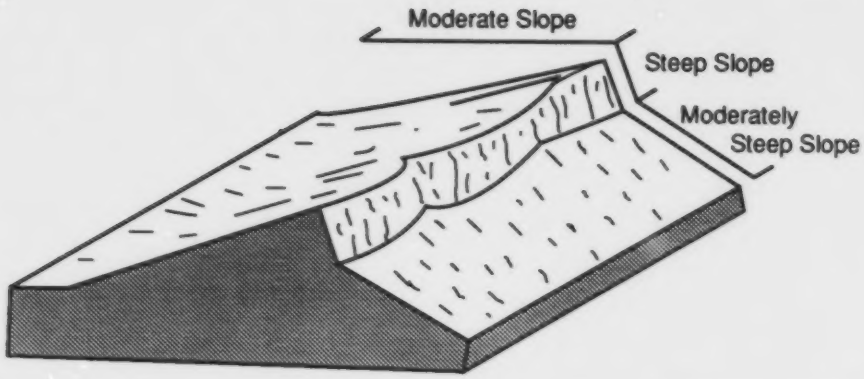


Figure 13. Block diagram illustrating the difference between steep, moderately steep and moderate slopes.

BLANKET Map Symbol: b

A mantle of unconsolidated materials thick enough to mask minor irregularities of the surface of the underlying unit, but still conforms to the general underlying topography. A blanket is greater than 1 metre thick and possesses no constructional forms typical of the materials genesis; outcrops of the underlying unit are rare.

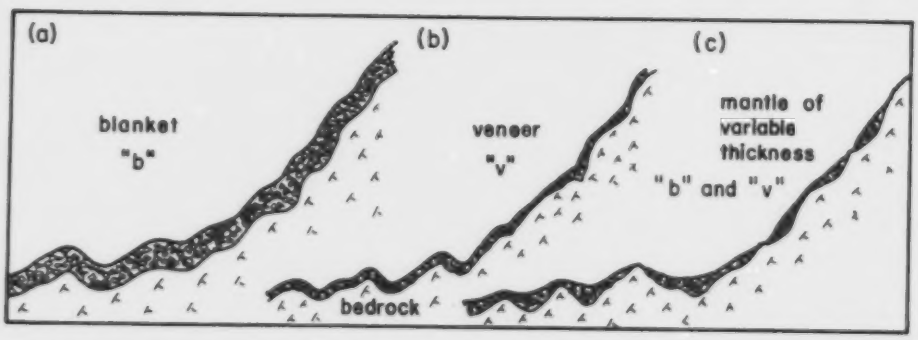


Figure 14. Schematic cross-sections that illustrate and distinguish the surface expression terms blanket and veneer.

Application and Examples:

- The surface expression of the blanket is expressed by either the surface expression of the underlying unit, or by the contour lines of the topographic map (Figures 14 and 15).

- If the underlying unit is unconsolidated material, its' presence is indicated as stratigraphic information (see pg. 60–61).

  Example: lacustrine blanket overlying hummocky moraine — $\frac{Lb}{Mh}$

- If the underlying unit is bedrock, no stratigraphic information need be supplied, except where the contours of the topographic map do not adequately depict the land surface.

  Examples: lacustrine blanket overlying bedrock with surface shape shown by contours — Lb

  lacustrine blanket overlying bedrock with surface shape not shown by contours — $\frac{Lb}{Rh}$

- If the underlying unit is not known, then the surface expression symbol alone may be used.

  Example: lacustrine blanket overlying undefined, hummocky materials — $\frac{Lb}{h}$

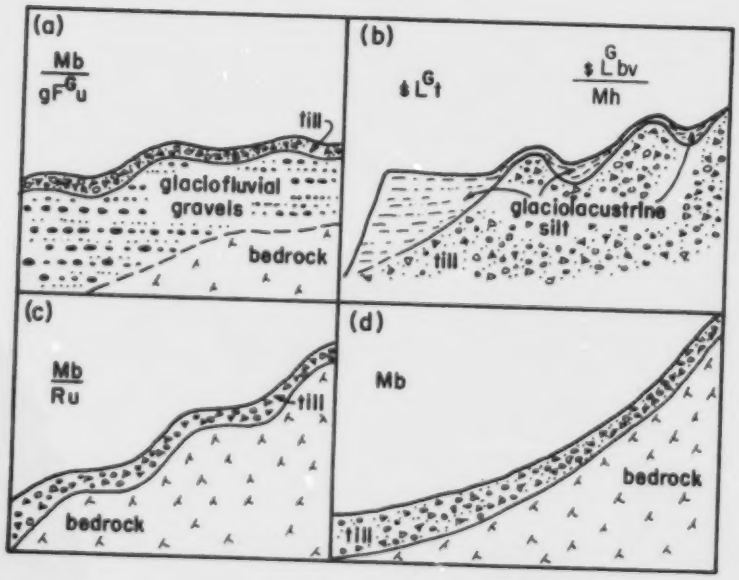


Figure 15. Schematic cross–sections to illustrate the use of stratigraphic symbols with the surface expression terms blanket and veneer. In (d), "Mb" is used alone because contours indicate the long, convex hillside.

CONE(S) Map Symbol: c

A cone or segment of a cone with a relatively smooth slope gradient from apex to toe greater than 15° (26%), and a longitudinal profile that is either straight, concave or convex.

Application and Examples:

- A cone is distinguished from a fan on the basis of slope gradient (Figure 16). Refer to FAN.
- Typically applied to talus cones, avalanche cones, coalescing cones where individual cones can be distinguished and volcanic cones of pyroclastic materials.

Examples:	talus cones	rCc
	avalanche cones	arCc-A
	cinder cone	rVc

- Small volcanic cones may be indicated by on–site symbols (see pg. 68).

(a) *(b)*

Figure 16. Block diagrams that illustrate the surface expression terms cone(a) and fan(b).

DEPRESSION(S) Map Symbol: d

Circular or irregular area of lower elevation (hollow) than the surrounding terrain and marked by an abrupt break in slope; side slopes within the depression are steeper than the surrounding terrain; depressions are two or more metres in depth.

Application and Examples:

- Typically used when mapping deposits containing kettle holes, karst depressions, or depressions caused by piping.

- If map scale permits, the term depression may be applied to a single enclosed depression.

Example:	a large hole in ice–contact materials	$gsF^{G}d$

- The origin of the depression, when known, should be indicated by the use of a "Geological Process" symbol (see pg. 39).

Example:	a kettle hole	$gsF^{G}d$-H
	pitted outwash plain	$sgF^{G}pd$-H
	glaciolacustrine terrace with depressions caused by piping	$mL^{G}td$-P

- On–site symbols for kettles, piping depressions, and karst depressions should be used instead of "d" where occurrence is of limited extent in relation to the whole map unit.

FAN(S) Map Symbol: f

A fan is a relatively smooth segment of a cone with a slope gradient from apex to toe, up to, and including 15° (26%), and a longtitudinal profile that is either straight, concave or convex.

Application and Examples:

- A fan is distinguished from a cone on the basis of slope gradient (Figure 16). Refer to CONE.

- Typically applied to fluvial (alluvial) fans, colluvial fans, or glaciofluvial fans.

Examples:	active colluvial fan	rCf
	"relict" fluvial fan	sgFf

- Applied to coalescing fans where individual fans are distinguishable.

HUMMOCK(S) Map Symbol: **h**

Steep sided hillock(s) and hollow(s) with multidirectional slopes dominantly between 15 and 35° (26 to 70%) if composed of unconsolidated materials; bedrock slopes may be steeper. Local relief is greater than 1 metre. In plan, an assemblage of non–linear, generally chaotic forms that are rounded or irregular in cross–profile.

Application and Examples:

- Hummocky unconsolidated materials are sufficiently thick to mask the surface irregularities of the underlying unit (Figure 17).
- Hummocky topography is distinguished from undulating topography on the basis of the predominant slope angles. Refer to UNDULATING TOPOGRAPHY.
- Commonly applied to knob–and–kettle topography, some landslide deposits, and hummocky bedrock.

Example:	kame–and–kettle glaciofluvial sediments	$gsF^{G}h\text{-}H$
	landslide debris	mdCh
	till veneer overlying hummocky bedrock	$\frac{Mv}{Rh}$

GENTLE SLOPE Map Symbol: **j**

An unidirectional (planar) surface with a slope gradient greater than 3°, to and including 15° (5 to 26%), and a smooth, longitudinal profile that is either straight, concave or convex; local surface irregularities generally have a relief of less than 1 metre.

Application and Examples:

- Does not include the surface expression fan. Refer to FAN.
- Commonly applied to constructional till deposits on gentle slopes, gently sloping beach or glaciofluvial deposits, and the floodplains of steep creeks.

Examples:	floodplain of a steep creek	$bgF^{A}j$
	thick till with gentle slopes and minor surface irregularities	dmMj

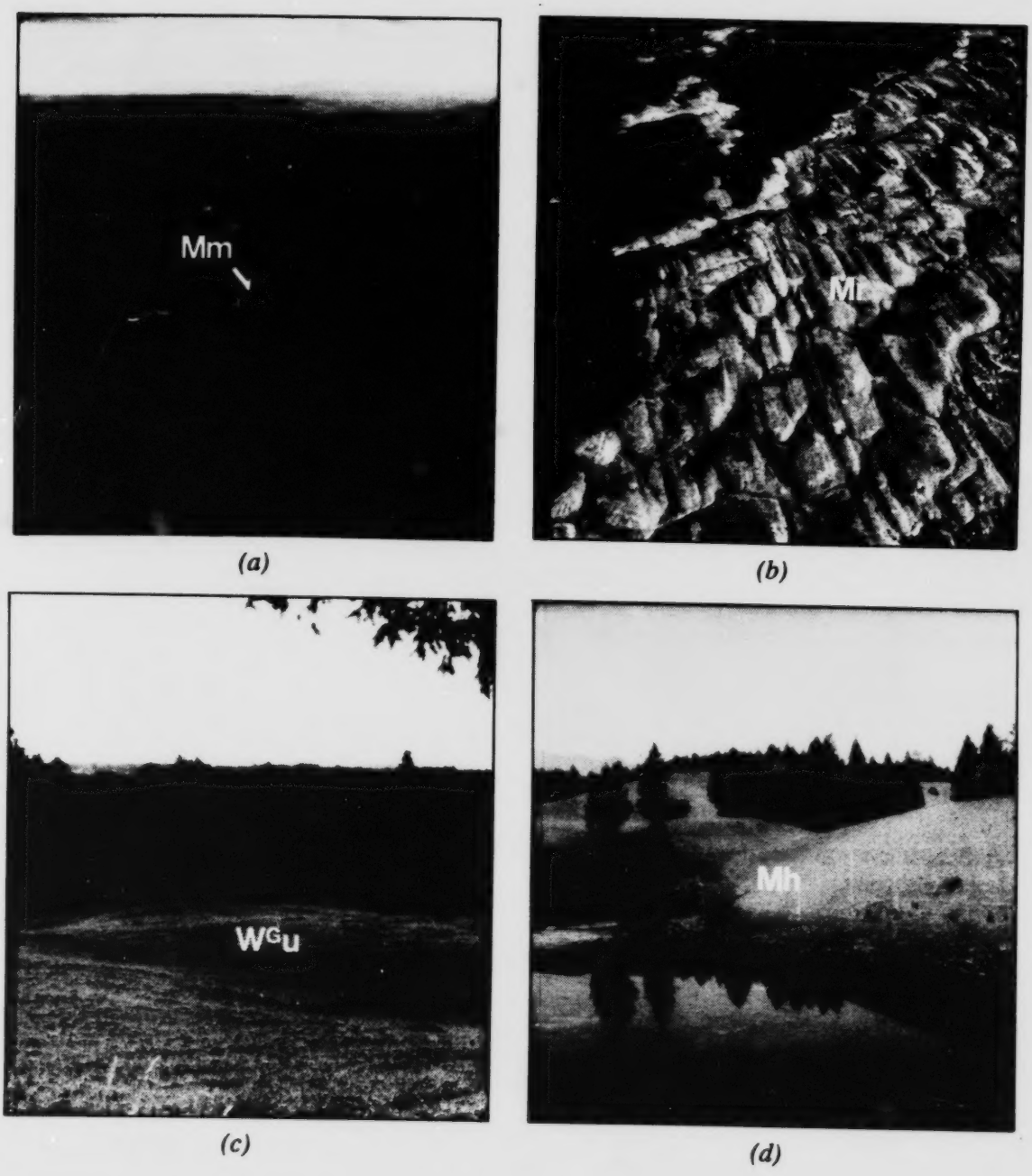


*Figure 17. Examples of the surface expression terms rolling, ridged, undulating and hummocky. (a) Rolling till plain made up of low, gently sloping drumlinoid features on the Nahlin Plateau in the northwest corner of British Columbia (map symbol: **Mm**); (b) Drumlinized till plain on the McGregor Plateau; the drumlins are linear features characterized by steep slopes (map symbol: **Mr**); (c) Undulating glaciomarine deposit in the Fraser Valley characterized by gentle slopes and irregularly distributed swales (map symbol: **WGu**); and (d) till hummocks with steep slopes in the Interior of British Columbia (map symbol: **Mh**).*

MODERATELY STEEP SLOPE Map Symbol: **k**

An unidirectional (planar) surface with a slope gradient greater than 26°, to and including 35° (50 to 70%), and a smooth, longitudinal profile that is either straight, concave or convex; local surface irregularities generally have a relief of less than 1 metre.

Application and Examples:

- Does not include the surface expression cone. Refer to CONE.
- Usually applied to moderately steeply sloping bedrock or constructional unconsolidated materials meeting the above definition (Figure 13).

Examples:	moderately steep sloping bedrock	Rk
	colluvial veneer overlying moderately steep, smooth bedrock	rCv / Rk

ROLLING Map Symbol: **m**

Elongate hillock(s) with slopes dominantly between 3 and 15° (5 to 26%) with local relief greater than 1 metre. In plan, an assemblage of parallel or sub–parallel linear forms with subdued relief.

Application and Examples:

- Rolling topography is distinguished from ridged topography on the basis of predominate slope angles (Figure 17). Refer to RIDGE.
- Rolling unconsolidated materials are sufficiently thick to mask the surface irregularities of the underlying unit.
- Commonly applied to fluted till plains, swell–and–swale topography, and subdued, beach and bedrock ridges.

Examples:	"washboard" moraine	Mm
	beach strandlines	Wm

- Where rolling topography is the result of glaciation and reflects former ice–flow direction, the appropriate on–site symbols should be applied to the terrain map (e.g. drumlins, flutings, and roche moutonées — pg. 66–67).

Example:	grooved till plain	Mm (with appropriate on–site symbol)

PLAIN **Map Symbol: p**

A level or very gently sloping, unidirectional (planar) surface with gradients up to, and including 3° (5%); local surface irregularities generally have a relief of less than 1 metre.

Application and Examples:

- Commonly applied to floodplains, deep organic deposits, lacustrine and marine plains, and the level portions of terraces and deltas (Figure 18).

Examples:	active floodplain	sgF^Ap
	thick organic deposit	Op
	silty lacustrine plain	$\not{s}Lp$

*Figure 18. Level to very gently sloping active delta deposit (map symbol: **sgF^Ap**) (location of photo: Port Hardy, Vancouver Island).*

RIDGE(S) **Map Symbol: r**

Elongate hillock(s) with slopes dominantly between 15 and 35° (26 to 70%) if composed of unconsolidated materials; bedrock slopes may be steeper. Local relief is greater than 1 metre. In plan, an assemblage of parallel or sub–parallel linear forms.

Application and Examples:

- Ridged unconsolidated materials are sufficiently thick to mask the irregularities of the underlying unit surface.

- Ridged topography is distinguished from rolling topography on the basis of predominate slope angles (Figure 17). Refer to ROLLING.

- Commonly applied to drumlinized till plains, eskers, morainal ridges, crevasse fillings and ridged bedrock.

Examples:	sandy gravel esker	$sgF^{G}r$
	morainal veneer overlying bedrock ridges	$\frac{Mv}{Rr}$

- Where ridged topography is the result of glaciation and reflects former ice–flow direction, the appropriate on–site symbols should be applied to the terrain map (e.g. drumlins, flutings, and roche moutonées — pg. 66–67).

Example:	drumlinized till plain	Mr (with appropriate on–site symbol)

STEEP SLOPE Map Symbol: **s**

An unidirectional (planar) surface with gradients greater than 35° (70%), and a smooth longitudinal profile that is either straight, concave or convex; local surface irregularities generally have a relief of less than 1 metre.

Application and Examples:

- Most commonly applied to steep erosional slopes of unconsolidated materials such as terrace scarps, river banks and lakeshore bluffs, steep bedrock slopes such as cliffs and steep slopes overlain with colluvial materials (Figure 13).

Examples:	cirque headwall	Rs
	lakeshore bluff	$L^{G}s$
	escarpment of a river terrace	Fs

- Where the map scale does not permit the delineation of a scarp, an on–site symbol should be applied to indicate the scarp location and extent (see pg. 68).

Example:	multiple fluvial terraces with narrow scarps	Ft (with scarp symbols)

TERRACE(S) Map symbol: **t**

A single or assemblage of step–like forms where each step–like form consists of a scarp face and a horizontal or gently inclined surface (tread) above it.

Application and Examples:

- Terrace is applied to both the scarp and the flat tread, that is, to the whole feature in the landscape; includes river and lake terraces, kame terraces and structurally–controlled, stepped topography (Figure 19).

Examples:	river terrace	gsFt
	stepped bedrock topography	Rt

- In units comprising more than one terrace, individual terrace scarps can be designated by a scarp on–site symbol (see pg. 68).

- If the scarp of a terrace is mapped as a separate terrain unit (e.g. Fs) then the associated flat tread should be designated by the surface expression symbol "p", or in some cases, "j".

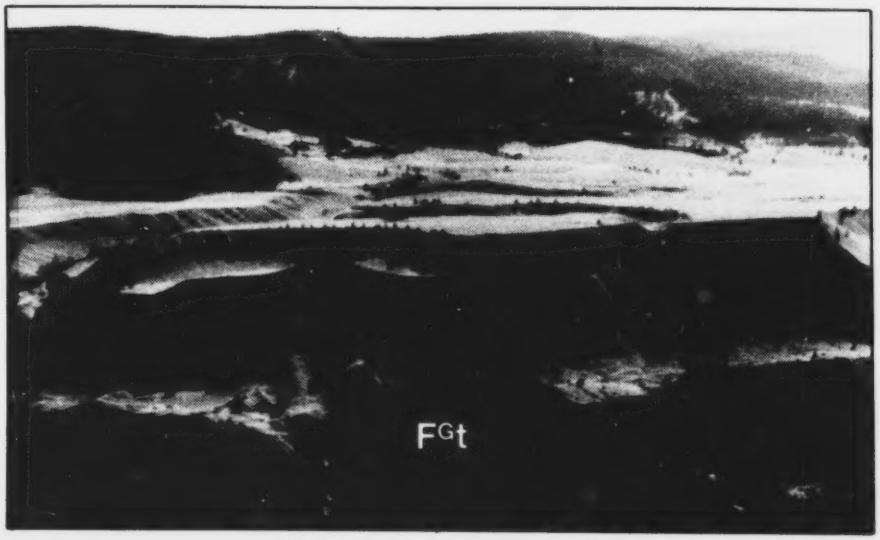


Figure 19. Terraces made up of thick Quaternary sediments (map symbol: $F^{G}t$) (location of photo: Churn Creek near the Gang Rach).

UNDULATING Map symbol: **u**

Gently sloping hillock(s) and hollow(s) with multidirectional slopes generally up to 15° (26%); local relief is greater than 1 metre. In plan, an assemblage of non–linear, generally chaotic forms that are rounded or irregular in cross–profile.

Application and Examples:

- Undulating topography made up of unconsolidated materials sufficiently thick to mask the surface irregularities of the underlying unit.

- Undulating topography is distinguished from hummocky topography on the basis of the predominant slope angles (Figure 17). Refer to HUMMOCK.

- Commonly applied to undulating till plains, some landslide and dune deposits, and some ice–contact deposits.

Example:	undulating till plain	Mu
	dunes on river terrace	Eu / Ft
	discrete areas of kame hummocks and undulations	$F^{G}hu$

VENEER Map symbol: **v**

A mantle of unconsolidated materials too thin to mask the minor irregularities of the surface of the underlying material. It ranges in thickness from 10 cm to 1 metre and possesses no form typical of the material genesis.

Application and Examples:

- The surface topography of the veneer is indicated by either the surface expression of the underlying unit, or as expressed by the contour lines of the topographic map (Figures 14 and 15).

- When the underlying unit is unconsolidated material, its' presence is indicated as stratigraphic information, (see pg. 60–61).

Example:	sandy eolian veneer overlying river terrace gravels	sEv / gFt

- If the underlying unit is bedrock, no stratigraphic information need be supplied, except where the contours of the topographic map do not adequately depict the land surface.

Examples:	colluvial veneer overlying bedrock with surface shape shown by contours	Cv
	colluvial veneer overlying bedrock with surface shape not shown by contours	Cv / Rh

- If the underlying unit is not known, then the surface expression of the underlying material alone may be indicated.

Example:	lacustrine veneer overlying undefined, hummocky materials	Lv / h

GEOLOGICAL (MODIFYING) PROCESSES

Geological processes are natural mechanisms of weathering, erosion and deposition that result in the modification of the surficial materials and landforms at the earth's surface.

The status of all geological processes in this classification are assumed to be "active", except for the geological processes, channeled by meltwater and kettled, which have an assumed status of "inactive". The status of activity of a geological process is indicated only if the status of the process is contrary to the assumed state as defined for each process. Status is indicated by a qualifying descriptor symbol as being active or inactive through the use of the superscripts "I" (inactive) or "A" (active). For further details refer to "Qualifying Descriptors", pg. 56–58.

GEOLOGICAL PROCESS TERMS AND SYMBOLS

Group	*Geological Process Name*	*Map Symbol*	*Assumed Status of Geological Process*
Erosional Processes	Deflation	**D**	active
	Karst processes	**K**	active
	Piping	**P**	active
	Gully erosion	**V**	active
	Washing	**W**	active
Fluvial Processes	Braiding channel	**B**	active
	Irregularly sinuous channel	**I**	active
	Anastamosing channel	**J**	active
	Meandering channel	**M**	active
Mass Movement Processes	Snow avalanches	**A**	active
	Slow mass movements	**F**	active
	Rapid mass movements	**R**	active
Periglacial Processes	Cryoturbation	**C**	active
	Nivation	**N**	active
	Solifluction	**S**	active
	General periglacial processes	**Z**	active
	Permafrost processes	**X**	active
Deglacial Processes	Channeled by meltwater	**E**	inactive
	Kettled	**H**	inactive
Other	Inundated	**U**	active

APPLICATION OF GEOLOGICAL PROCESSES

- Geological process symbols are applied where a relatively large portion (area) of a map unit is being modified by a process (e.g. solifluction), or where several sites within the unit are being affected (e.g. rapid mass movement processes). The areal proportion or number of sites that is required is not normally stated, however, it may be defined in the map legend at the mappers' discretion.

- Up to three geological process terms may be applied in a terrain unit symbol and are placed after a dash at the end of the symbol for both simple and composite terrain units (see Composite Units, pg. 59–60).

  Examples: simple terrain unit — $\not{s}L^{G}t$-V

  composite terrain unit — $sgF^{G}t/\not{s}L^{G}t$-V

  Note: If the terrain data is being entered onto CAPAMP, the option exists to indicate the geological processes such that they describe the genetic material affected rather than the polygon as a whole.

- On–site symbols can be used for certain geological processes to indicate modification of a relatively small portion of a map unit or where the specific location of a process needs to be shown. The available on–site symbols are indicated in the descriptions of the geological process terms.

- Where two or more geological process symbols are used, they are written in order of decreasing visible areal extent. No information about frequency and intensity of the event is intended.

DEFINITION OF GEOLOGICAL PROCESS TERMS

Erosional Processes

Erosional processes involve the erosion of earth materials by either flowing water (on or below the land surface), or by the action of wind, or through the chemical solution of rocks such as limestone.

DEFLATION Map symbol: **D** Process status: **active**

The removal of sand and silt sized particles from unconsolidated materials by wind action (i.e. wind erosion).

Application and Examples:

- Most likely to apply in areas that are sparsely vegetated due to aridity, cold temperatures or recent deposition of surface materials; features such as deflation hollows, exposed roots and the presence of nearby dunes, and gravel lag deposits are indicative of this process.

  Example: deflated lacustrine terrace — $\not{s}$Lt-D

KARST PROCESSES

Map Symbol: **K** Process status: **active**

Processes associated with the solution of carbonates (e.g. limestone, dolomite) ana other soluble rocks; includes surface and underground weathering, and collapse and subsidence resulting from solution.

Application and Examples:

- Applied to carbonate and other rocks whose surfaces are marked by features such as sinkholes, uvalas, caves, surface etching, and limestone pavements.

  Example: limestone outcrop with caves and sinkholes Ru-K

- Applied to depressions in surficial material that result from solution and subsidence in the underlying bedrock.

  Example: till blanket with depressions due to karst modification of underlying bedrock $\frac{Mb}{R}$ - K

- Large and small karst depressions may be shown by an on–site symbols.

PIPING

Map symbol: **P** Process status: **active**

Subterranean erosion of surficial materials by flowing water that results in the formation of tubular underground conduits due to the sub–surface removal of particulate matter.

Application and Examples:

- Applied to surfaces exhibiting modification in the form of small hollows (depressions) irregularly arranged or aligned along routes of subsurface drainage (beaded gullies); these features occur most commonly in lake silts (Figure 20).

  Example: piping in a lacustrine terrace ∮Lt-P

- Piping may also occur in alluvium, volcanic ash and occasionally in till and colluvium as evidenced by pipes in cross–sectional exposures.

- Depression resulting from piping may be shown by an on–site symbol.

Figure 20. Gullied terrace of glaciolacustrine silt undergoing modification by piping as indicated by the circular and semi–circular depressions (arrows) on the surface of the terrace (map symbol: sLGt-VP) (location of photo: Okanagan Valley, southwest British Columbia).

GULLY EROSION Map symbol: **V** Process status: **active**

The modification of unconsolidated and consolidated surfaces by various processes such as running water, mass movement and snow avalanching that results in the formation of parallel and sub–parallel long, narrow ravines.

Application and Examples:

- Gullies may have either steep or gentle sloping sides, and either steep or gently sloping longitudinal profiles. They are much smaller than valleys but larger than rills and occur on various type of terrain such as steep mountain slopes, escarpments and terraces (Figure 21).

Examples:	a till mantle overlying steep bedrock dissected by gullies	$\frac{\text{Mbv}}{\text{Rs}}$ - V
	lacustrine terrace dissected by gullies	Lt-V

- Individual gullies of infrequent occurrence may be indicated by on–site symbols.

*Figure 21. Gullied till in the Coast Range of British Columbia (map symbol: **Ms-V**).*

WASHING Map Symbol: **W** Process status: **active**

The modification of a surficial material by wave action or, occasionally, running water (e.g. meltwater) resulting in lag deposits formed by the removal of fines from a mixture of coarse and fine particles, or wave–cut platforms.

Application and Examples:

- Commonly applied in areas of former glacial lakes, marine inundation or areas of meltwater runoff. Active washing occurs along present shorelines.

- The process generally results in the formation of a thin lag gravel; thicker, water–deposited gravels (e.g. beaches) should be mapped as discrete units of surficial material.

Examples:	gravel pavement (lag) on till plain due to wave action in an ancient lake	Mp-W[l]
	marine beach gravels overlying a till plain	$\frac{gWj}{Mp}$

Fluvial Processes

The behaviour of a river is a complex function of its' discharge, sediment load and gradient. Analysis of these parameters is beyond the scope of terrain mapping, however over time, a particular kind of river behaviour results in a characteristic set of features, such as the type and distribution of floodplain sediments and floodplain vegetation, floodplain and channel zone morphology, and channel pattern. These features are amenable to air photo interpretation and can be mapped and interpreted as part of terrain analysis. The classification of fluvial processes is based primarily on channel patterns of rivers as these provide a useful basis for the interpretation of fluvial hazards and other river characteristics.

BRAIDING CHANNEL

Map Symbol: **B** Process status: **active**

A channel zone characterized by many diverging and converging channels separated by unvegetated bars, and temporary islands of gravel and sand. Many channels are dry at moderate and low flows, but during major floods, the entire channel zone may be occupied by flowing water.

Application and Examples:

- Most commonly applied to active floodplains, fluvial fans and distributary channels on deltas (Figure 22).

  Example: active braiding channel on floodplain — $sgF^{A}p\text{-}B$

- Abandoned braided channels are classified as inactive.

  Example: abandoned braided channel on outwash plain — $sgF^{G}p\text{-}B^{I}$

*Figure 22. An example of a braiding channel at moderate to low flow (map symbol: **$sgF^{A}p\text{-}B$**) (location of photo: Southgate River).*

IRREGULARLY SINUOUS CHANNEL Map Symbol: **I** Process status: **active**

A single, clearly defined main channel displaying irregular turns and bends without repetition of similar features; backchannels may be common and minor side channels and a few bars and islands may be present but regular and irregular meanders are absent.

Application and Examples:

- Applicable only to active floodplains and fluvial fans (Figure 23).

Example: fluvial fan displaying irregularly sinuous channel — gF^f-I

*Figure 23. An irregularly sinuous channel; note there is a single clearly defined main channel although there are many backchannels (map symbol: **sgF^p-I**) (location of photo: Bella Coola River).*

ANASTAMOSING CHANNEL Map Symbol: **J** Process status: **active**

A channel zone where channels diverge and converge around many islands. The islands are vegetated and have surfaces that are relatively far above mean maximum discharge levels. Some channels are dry at moderate or low flows.

Application and Examples:

- Applicable only to active floodplains and fluvial fans (Figure 24).

- Most anastamosing rivers occupy gravel channels; islands consist of relatively thick sequences of overbank silt and sand which overlie gravel at low–water level.

Example: anastamosing gravel channel with islands of silty sand overlying gravel $\frac{gF^{\wedge}p/sF^{\wedge}bv}{gF^{\wedge}p}$ - J

*Figure 24. The Stikine River in the Coast Mountains, an example of anastamosing channel (map symbol: **F^p-J**).*

MEANDERING CHANNEL Map Symbol: **M** Process status: **active**

A clearly defined channel characterized by a regular and repeated pattern of bends with relatively uniform amplitude and wave length.

Application and Examples:

- Applied to active floodplains that display features ranging from meander scars and cut–offs (ox–bow lakes) to regular scroll patterns (Figure 25). Zoned (i.e. linear pattern) successional vegetation may be present on point bars. Channel may be bounded by levees.

Example: floodplain with a meandering channel sgF^p-M

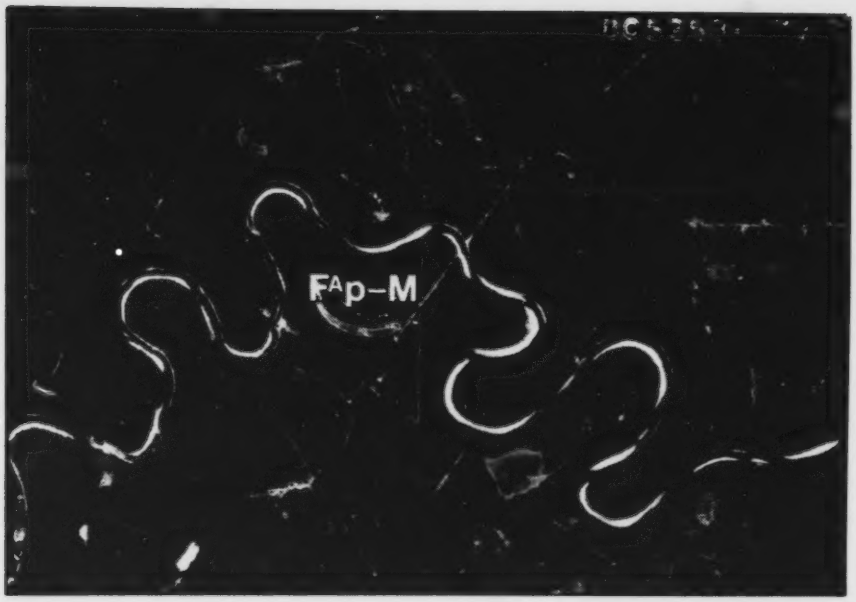


*Figure 25. A meandering channel; note uniform size of meanders (and cutoffs) (map symbol: **F^p-M**) (location of photo: Kahntah River).*

Mass Movement Processes

Mass movement processes involve the downslope movement, due to gravity, of surficial materials such as bedrock fragments, or snow and ice, often mixed with vegetation debris. This classification distinguishes three types of mass movements based on the rate of movement, and the presence of snow and/or ice. Subclass modifier symbols may be used with these categories in order to indicate specific processes (see Subclass Modifiers pg. 61–65).

SNOW AVALANCHES Map Symbol: **A** Process status: **active**

Rapid downslope movement of snow and ice, as well as incorporated rock, surficial material and vegetation debris by flowing or sliding.

Application and Examples:

- Applied to terrain where snow avalanches initiate, track and deposit (runout zones) (Figure 26).

Example: avalanche cone Cc-A

- Commonly associated with areas of high local relief and moderate to heavy snowfall. Slopes modified by snow avalanches are characterized by linear scars traversing down the slope and whose vegetation pattern distinctly demarks a sharp trimline with the adjacent forested slope. Above the treeline avalanche paths are not well marked.

  Example: steep rocky slope modified by avalanches Rs-A

- Applied to terrain affected by falling ice from glaciers.

- Specific avalanche paths can be identified by on–site symbols.

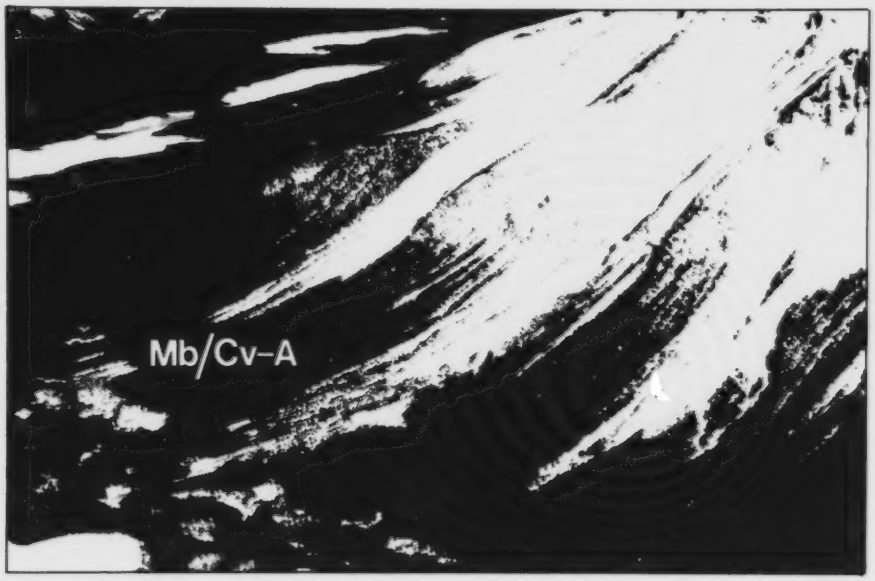


*Figure 26. A valley side slope made up of till and colluvium that has been subject to several snow avalanches; note the varying length of the runout zones (map symbol: **Mb/Cv-A**).*

SLOW MASS MOVEMENTS Map Symbol: **F** Process status: **active**

Slow downslope movement of masses of cohesive or non–cohesive surficial material and/or bedrock by creeping, flowing or sliding.

Application and Examples:

- Applied to terrain where slow mass movements initiate, erode and deposit; includes slow earthflows, rotational slumps, rock glaciers, and lateral spreads. Terrain affected by slow mass movements usually displays irregular, chaotic or hummocky topography bounded upslope by an arcuate scarp; lateral margins may be marked by levee–like ridges, and seepage or small ponds may be present (Figure 27). Also includes soil creep; in steep mountainous terrain where soil creep is a common process, it should only be applied to sites showing significant alteration by creep processes.

- Applied to terrain units that consist entirely of unstable material, or to terrain units which include small areas where failure is occurring.

Examples:	earthflow	Chr-F
	glaciolacustrine terrace with several small slumps	$\not$L^{G}t-F

- Slow movement may be indicated by the presence of tension cracks, tilted or jackstrawed trees, and displacement of man–made features such as roads and fence lines.

Example:	tension cracks indicating incipient failure of bedrock	Rst-F

- On–site symbols can be used to delineate specific failure headwall scars and paths.

- Additional information regarding specific slow mass movement processes can be indicated using subclass modifier symbols (see pg. 61–65).

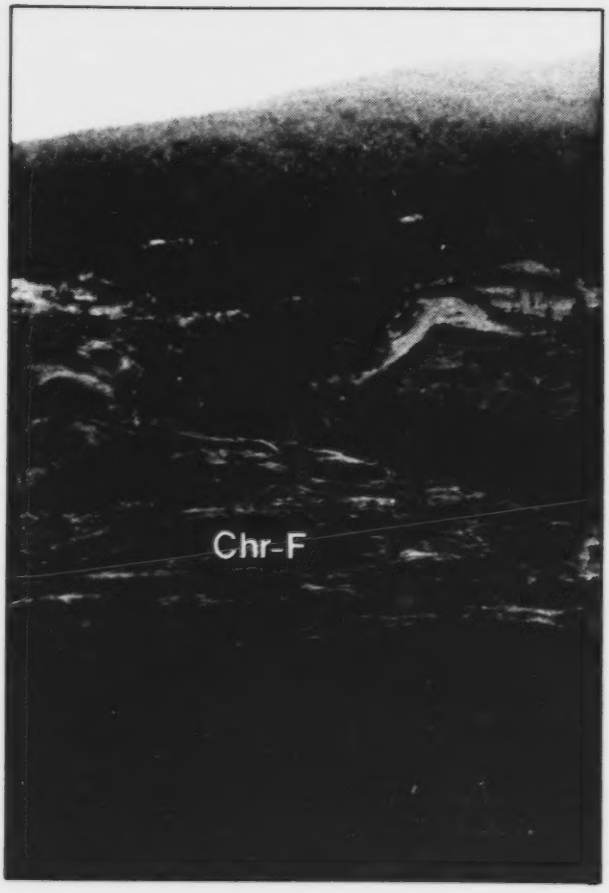


*Figure 27. Hummocky and irregular topography of lower portion of the Pavillion earthflow — a slow mass movement (map symbol: **Chr-F**) (location of photo: near Pavillion, central British Columbia).*

RAPID MASS MOVEMENTS — Map Symbol: R — Process status: active

Rapid downslope movement of dry, moist or saturated debris derived from surficial material and/or bedrock by falling, rolling, sliding or flowing.

Application and Examples:

- Applied to terrain where rapid mass movements initiate, erode and deposit (Figure 28). It includes rock or earth falls; rock slides; debris slides, flows and torrents. These processes result in a range of features from small linear tracks (bare or vegetated) that terminate at depositional sites such as fans, cones or chaotically arranged hummocks (e.g. debris flow) to large accumulations of debris characterized by lobate, hummocky or ridged topography with an arcuate slide scar upslope (e.g. rockslide).

Examples:	till slope modified by debris slides	Mbv-R
	talus slope derived from rockfall	arCa-R
	large inactive rockslide deposit	$aC^{h}r\text{-}R^{I}$

- On–site symbols can be used to delineate specific failure headwall scars and paths.

- Additional information regarding specific rapid mass movement processes can be indicated using subclass modifier symbols (see pg. 61–65).

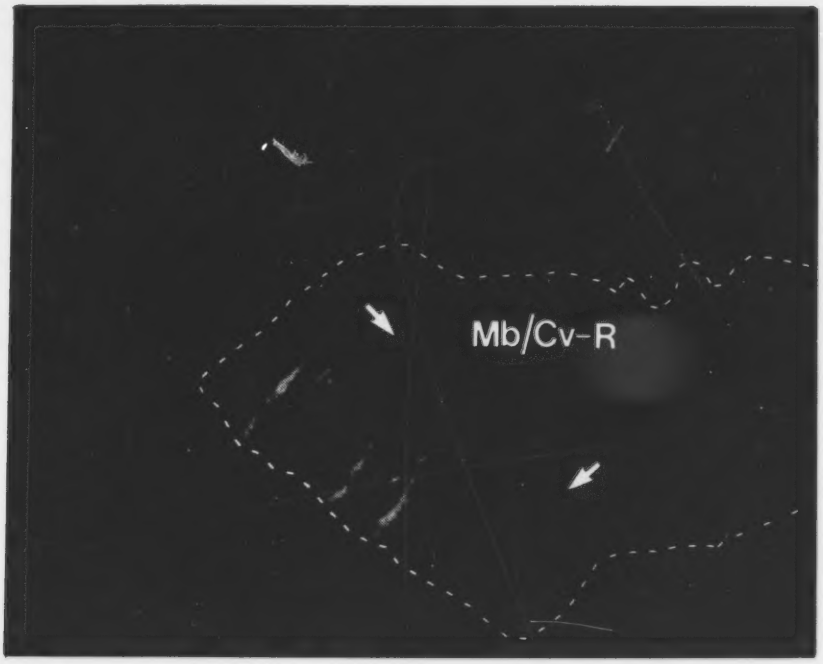


*Figure 28. Recent debris slides and flows (rapid mass movements) on steep slopes made up of till and colluvium; recent failures appear as white linear scars whereas older failures can be identified by their uniform revegetation pattern (arrow) (map symbol: **Mb/Cv-R**) (location of photo: west coast of Vancouver Island).*

Periglacial Processes

Periglacial processes designate non–glacial phenomena of cold climates such as permafrost and frost related processes. They are commonly associated with alpine and subalpine areas.

CRYOTURBATION — Map Symbol: C — Process status: active

Movement of surficial materials by heaving, sorting and/or churning due to frost action (repeated freezing and thawing).

Application and Examples:

- Applied to areas of patterned ground where features such as sorted and non–sorted circles, earth hummocks, and sorted and non–sorted polygons result from freeze–thaw processes (Figure 29).

Example: stone polygons on morainal blanket — Mb-C

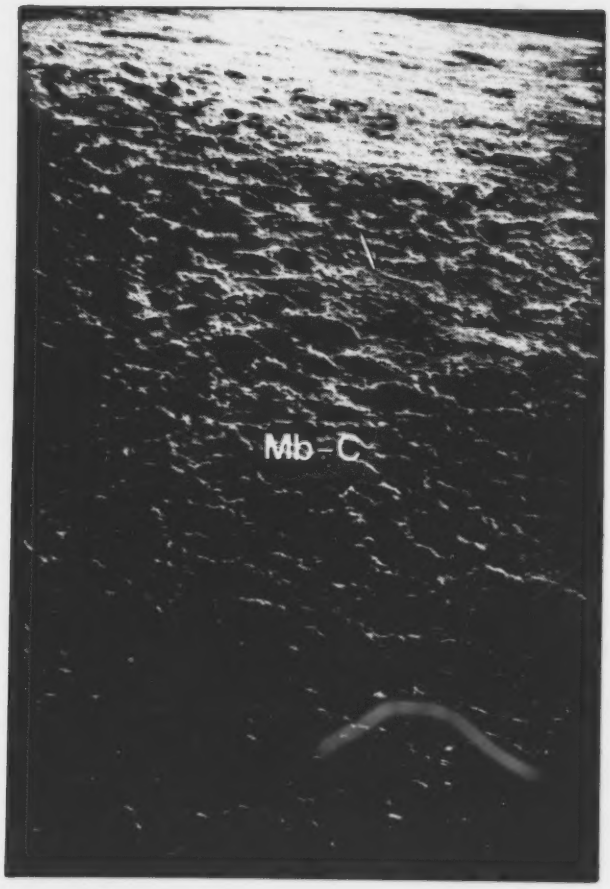


*Figure 29. Patterned ground, evidence of cyroturbation in till materials (map symbol: **Mb-C**) (location of photo: northern British Columbia).*

NIVATION — Map Symbol: N — Process status: active

Erosion of bedrock or surficial materials beneath and along the margin of snow patches by freeze–thaw processes (frost shattering and heave), meltwater action and snow creep.

Application and Examples:

- Applied to areas where transverse, longitudinal, circular and/or irregular nivation hollows occur.

  Example: nivation hollows on rolling till plain — Mm-N

SOLIFLUCTION — Map Symbol: S — Process status: active

Slow gravitational downslope movement of saturated, non–frozen surficial material behaving apparently as a viscous mass over a surface of frozen ground.

Application and Examples:

- Applied to areas where solifluction lobes, sheets and terraces are frequent or widespread (Figure 30).

  Example: solifluction lobes in a colluvial blanket — ŧrCb-S

- Material transported by solifluction is classified as its source material although technically solifluction material is colluvium.

  Example: solifluction lobes on till — Mb-S

Figure 30. Solifluction lobes (highlighted by the dark tones) in till materials in the alpine zone (map symbol: Mb-S) (location of photo: Omineca Mountains).

GENERAL PERIGLACIAL PROCESSES Map Symbol: Z Process status: active

Solifluction, cryoturbation and nivation occurring together within a single terrain unit.

Application and Examples:

- Commonly used in small scale and generalized mapping and is applied instead of "–CNS".

Example:	moderately sloping alpine area of till on small scale map	Ma-Z

PERMAFROST PROCESSES Map Symbol: X Process status: active

Processes controlled by the presence of permafrost, and permafrost aggradation or degradation. "Permafrost" is earth material whose temperature remains below 0°C continuously for more than two years.

Application and Examples:

- Applied to terrain where any of the following features are present: ice–wedge polygons; thaw lakes or other thermokarst features; surficial materials containing interstitial or segregated ice (ice lenses); palsas, pingos and stone circles.

Examples:	bog with palsas	Op-X
	lacustrine plain with ice wedge polygons	Lp-X

- Permafrost cannot be identified on the basis of a single (at one point in time) observation. If during field work, frozen ground is encountered during late summer or fall, it may be permafrost, however, if no permafrost landforms are present the permafrost symbol should not be used. Instead, the site should be identified with the frozen ground on–site symbol.

Deglacial Processes

Processes resulting from melting ice and meltwater during deglaciation.

CHANNELED BY MELTWATER Map Symbol: **E** Process status: **inactive**

Erosion and channel formation by meltwater alongside, beneath, or in front of a glacier or ice sheet.

Application and Examples:

- Applied to terrain dissected by meltwater channels (Figure 31); channels vary in length and range from broad, shallow channels to deeply–incised, steep–sided, flat–bottomed valleys. Channels may run across or along slope contours and presently may be dry, poorly drained or contain a stream (often a misfit stream).

Example:	morainal mantle on a slope dissected by several lateral meltwater channels	Mbv-E

- Specific small and large meltwater channels may be indicated by on–site symbols (see pg. 67).

*Figure 31. Lateral meltwater channels developed on a slope made up of till; the channels formed during the last deglaciation (map symbol: **Mb-E**) (location of photo: Spatzizi Plateau, northwest corner of British Columbia).*

KETTLED Map Symbol: **H** Process status: **inactive**

Depressions in surficial materials resulting from the melting of buried or partially buried glacier ice.

Application and Examples:

- Kettles are depressions lower in elevation than the surrounding terrain and are characterized by steep sides bounded by abrupt, convex breaks in slope. They occur in a variety of shapes from round to irregular forms (Figure 32).

  Example: pitted outwash terrace $sgF^{G}t$-H

- Site specific small and large kettle holes can be indicated by on–site symbols (pg. 67).

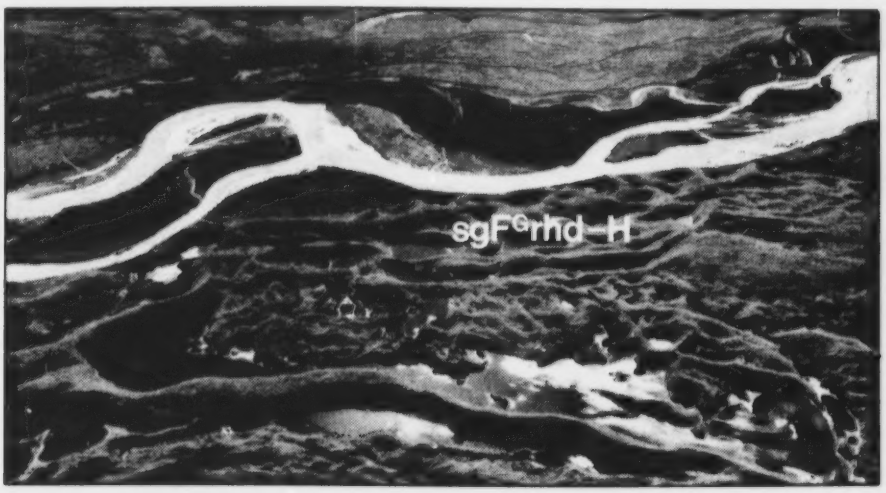


Figure 32. Pitted or kettled topography made up sandy gravel glaciofluvial eskers and kames (map symbol: sgF^{G}rhd–H) (location of photo: Liard Plain, northeast corner of British Columbia).

Other

INUNDATION Map Symbol: **U** Process status: **active**

Terrain seasonally under standing water which results from high watertable.

Application and Examples:

- Commonly applied to ephemeral lakes whose floors are mapped as terrain units, and to surficial materials with seasonally high watertables that exceed ground surface levels for a continuous and significant time period (greater than one month).

  Example: ephemeral lake on lacustrine plain Lp-U

QUALIFYING DESCRIPTORS

Qualifying descriptor symbols provide additional information about the mode of formation and/or depositional environment of surficial materials and the status of activity of geological processes.

APPLICATION TO SURFICIAL MATERIALS

Qualifying descriptors are used to qualify or provide additional information regarding surficial materials. These are denoted by an upper case superscript following the qualified surficial material symbol. Two distinct types of qualifiers are available: (1) glacial qualifying descriptor, and (2) activity qualifying descriptors.

Glacial Qualifying Descriptor

The "glacial" descriptor "G" is used to qualify surficial materials where there is direct evidence that glacier ice exerted a strong although secondary control upon the mode of origin of the material. The use of this qualifying descriptor implies that glacier ice was close to the site of deposition of the material. The most common types of glacially–modified materials are included in the surficial material classes (listed on pg. 10). However, the "glacial" modifier may be used with other materials where necessary; appropriate descriptions should be added to the map legend and terrain report.

Application and Examples:

- Applied to surficial materials that exhibit any of the following: kettled or irregular (hummocky or ridged) surfaces that result from the melting of buried or partially buried ice; slump structures indicating partial collapse of a landform due to melting of supporting ice; ice–contact and moulded forms such as crevasse fillings and eskers; non–sorted and non–bedded gravel with a wide range of particle sizes resulting from very rapid aggradation at an ice front; the presence of flowtills; and the presence of ice–rafted stones in glaciolacustrine or glaciomarine deposits.

Examples:	kettled outwash plain	$sgF^{G}p$-H
	silty lacustrine terrace with ice–rafted stones	$\not{s}L^{G}t$

- Surficial materials that display none of the ice–contact features described above can be qualified by the "glacial" descriptor term if reconstruction of the geological history indicates a glacial source.

Activity Qualifying Descriptors

The "activity" qualifying descriptors "I" and "A" are used to indicate whether a surficial material is undergoing formation (or deposition) at the present time.

Application and Examples:

- By definition, each surficial material has an assumed status of activity (as discussed on pg. 10). If the actual state of activity of the surficial material is contrary to the assumed state, then the actual state is indicated by attaching the appropriate superscript to the surficial material symbol. If the actual state is the same as the assumed state, no superscript is used.

Examples:	fluvial terrace high above river level *(actual state and assumed state, are the same)*	Ft *(qualifier is not shown)*
	floodplain subject to shifting channels *(actual state is active, contrary to assumed state)*	$F^{\wedge}p$ *(qualifier is shown)*
	outwash in front of a modern glacier *(actual state is active, contrary to assumed state)*	$sgF^{AG}p$ *(qualifier is shown)*

- A surficial material is "active" if there is evidence of its recent deposition. The nature of the evidence varies with the type of process, but will include some of the following:

  i) Absence of vegetation or presence of immature or successional vegetation; recently disturbed or damaged vegetation.
  ii) Lack of soil development (immature soil); recently deposited sediment overlying soil or litter layers (cumulic soil horizons).
  iii) Fresh, unweathered surface with no lichen or moss cover.
  iv) Historical records and air photographs; eyewitness accounts.
  v) Indications of an active sediment supply.

APPLICATION TO GEOLOGICAL PROCESSES

Only "activity" qualifying descriptors are applied to the geological process terms.

Activity Qualifying Descriptors

The "activity" qualifying descriptors "I" and "A" are used to indicate the status of activity of the geological process at the present time.

Application and Examples:

- By definition all geological processes are assumed to be active except for deglacial processes which are assumed to be inactive (see pg. 39). If the actual state of activity of the geological process is contrary to the assumed state, then the actual state is indicated by attaching the appropriate superscript to the geological process symbol. If the actual state is the same as the assumed state, no superscript is attached.

Examples:	active sand dunes and deflation hollows (actual and assumed states, are the same)	sE^{A}r-D *(process qualifier is not shown)*
	vegetated sand dunes and deflation hollows (actual state is inactive, contrary to assumed state)	sEr-D^{I} *(process qualifier is shown)*

- Geological processes should be considered active for terrain mapping purposes if there is evidence of current or recent occurrence, or likely future occurrence. Indicators of present or future activity include freshly deposited sediments, visible slope instability, soil and vegetation characteristics or other features in the landscape (refer to Activity Qualifying Descriptors for surficial materials).

- The use of the "activity" qualifying descriptors is not defined in quantitative terms (e.g. once every hundred years) because the assessment of the frequency of most geological processes (e.g. floods, snow avalanches) is beyond the scope of this terrain classification system.

TYPES OF TERRAIN UNIT SYMBOLS

Not all terrain can be mapped and presented as simple terrain units. The simple terrain unit may have to be modified in order to:

- ***Describe map units that include more than one type of terrain (composite units).***
- ***Provide subsurface information (stratigraphic units).***
- ***Provide additional information (often project specific) about surficial materials and/or geological processes (subclass modifiers).***

COMPOSITE UNITS

Terrain units commonly occur that are of small areal extent and which cannot be delimited individually at the scale of mapping. Consequently, a system of composite units is employed whereby up to three types of surficial material may be designated within a terrain unit boundary. A composite unit is made up of two or three simple terrain units (each referred to as a component of the composite unit) with the geological process symbols placed after a dash at the end of the symbol. The components are arranged in decreasing order of areal extent and are separated by delimiters (that infer relative amounts) or deciles. Surficial material that occupies less than 10% of a terrain unit is generally not indicated in the terrain unit symbol.

Delimiters

Delimiters indicate the relative amount of each surficial material type in a composite terrain unit. The delimiter symbols are an equal sign (=) and a single or double slash (/, //).

Map Symbol	*Definition*
=	components on either side of the symbol are approximately equal in proportion
/	the component in front of the symbol is more extensive than the one that follows
//	the component in front of the symbol is considerably more extensive than the component that follows

Examples of all possible combinations of delimeter symbols and their interpretation follows:

Mb=R	Mb and R are roughly equal
Mb/R	R is less than Mb
Mb//R	R is considerably less than Mb
Mb=R=Cv	Mb, R and Cv are all roughly equal
Mb=R/Cv	Mb and R are roughly equal; Cv is less than each of Mb and R
Mb=R//Cv	Mb and R are roughly equal; Cv is considerably less than each of Mb and R
Mb/R=Cv	R is less than Mb; R and Cv are roughly equal
Mb/R/Cv	R is less than Mb; Cv is less than R
Mb/R//Cv	R is less than Mb; Cv is considerably less than R
Mb//R=Cv	Mb is considerably more extensive than each of R and Cv; R and Cv are roughly equal
Mb//R/Cv	R is considerably less than Mb; Cv is less than R
Mb//R//Cv	R is considerably less than Mb; Cv is considerably less than R

Deciles

Where appropriate, deciles instead of delimiters may be used to indicate the proportion of each terrain symbol component. The decile, as a superscript, follows immediately after the component described. The reliability of the decile estimates should be noted on the map legend. The decile designation of terrain symbol components is required for the storage of terrain data in the Computer Assisted Planning, Assessment and Map Production (CAPAMP) geographic information system (see Appendix III).

Examples:	Mb and Rh each occupy about 50% of the terrain unit area	Mb^5Rh^5
	The unit consists of 60% Mb, 30% rock, and 10% colluvium	$Mb^6R^3Cv^1$

STRATIGRAPHIC UNITS

Stratigraphic units are used when two or more kinds of surficial materials are superimposed (Figure 33). They are commonly applied to terrain units where the depth of the surface material is such that the nature of the underlying material(s) may be important, and/or where it is necessary to show the character of the underlying material(s). Superimposed materials are indicated by a vertical alignment of the materials, which are arranged in stratigraphic order with each material separated by a horizontal line as indicated in the examples below. Texture and surface expression symbols may be attached to underlying materials, if appropriate. Commonly, only two or three superimposed materials are indicated in this manner. Specific rules have been developed for the presentation of stratigraphic information for surface materials defined as blankets or veneers (see pg. 28 and 38, respectively). Stratigraphic units may be simple terrain units or form component(s) of composite terrain units.

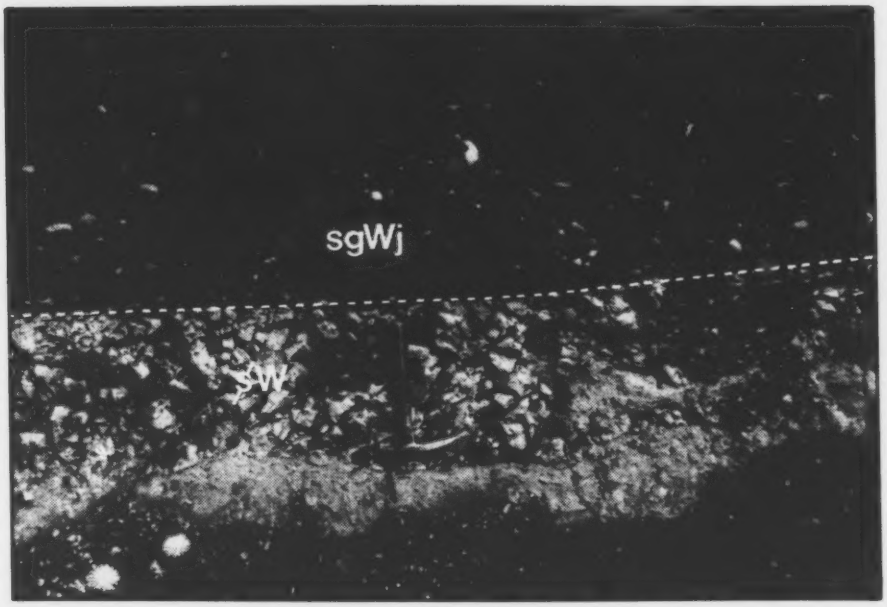


Figure 33. An example of a stratigraphic unit; sandy gravel beach materials on a gentle slope overlying silty marine sediments (map symbol: $\frac{sgWj}{gW}$) (location of photo: Vancouver Island).

Examples:

veneer of eolian silt overlying terraced fluvial gravels	$\frac{sEv}{gFt}$
hummocky morainal materials overlying glaciofluvial gravels	$\frac{Mh}{gF^{G}}$

SUBCLASS MODIFIERS

Subclass modifiers can be incorporated in terrain unit symbols to provide further information about a surficial material or a geological process which is not part of the basic terrain classification. The subclass modifiers are functional tools that may be defined according to the purpose of a terrain survey. Subclass modifiers are indicated by whole numbers for surficial materials and either whole numbers or alpha characters for geological processes. They are placed immediately after the surficial material or geological process symbol modified. There are a number of situations in which subclass modifiers can be applied in a terrain mapping program to meet project objectives. The following is a list of typical applications.

As applied to surficial materials:

- to discriminate between different types of till based on specific physical and/or chemical properties, such as compaction, clast mineralogy, presence and type of heavy minerals, calcium carbonate content, etc.

- to classify the bedrock source of colluvial mantles.

- to indicate the type of organic sediment or landform.

Example: Use of subclass modifier codes to identify calcareous/noncalcareous tills.

M1b 1 used to indicate noncalcareous till
M2b 2 used to indicate calcareous till

As applied to geological processes:

- to expand the classification of mass movement processes by identifying specific types of processes such as rockfall, debris slide, etc.

- to indicate the initiation, transport or deposition zone of a mass movement process.

- to provide lateral instability and backchannel characteristics of a river or stream.

- to indicate the different geomorphological forms of gullies.

- to identify specific permafrost processes and features in areas of extensive permafrost.

Example: Use of subclass modifier to indicate types of backchannels in a floodplain for fishery applications.

F^p-Mc "c" used to indicate meandering river with backchannels with flowing or standing water year–round

F^p-Me "e" used to indicate meandering river with backchannels dry during late summer

In British Columbia, the Terrain Correlator* should be consulted during the development of subclass modifier symbols and their definitions. This promotes the development of standardized sets of subclass modifiers for various applications and consistency in their use. It also deters the propagation of multiple sets of symbols and definitions for similar applications. To date, one set of standard subclass modifiers has been developed for the geological processes, slow and rapid mass movements (see Table 3 and Figure 34). This standard set of subclass modifiers should be applied whenever designation of these specific mass movement processes is required. In practice, they have been extensively applied in projects

requiring assessment of geologic hazards and slope stability analysis. Examples of the use of mass movement subclass modifiers follows.

Examples:	glaciofluvial terrace with several rotational slumps	F^{G}t-Fu
	active earthflow	⸗Chu-Fe
	talus slope subject to rockfalls	rCa-Rb
	moderately steep slope overlain by till with several debris slides	d⸗Mk-Rs

* Presently, Mr. Don Howes, Senior Geologist, Recreational Fisheries Branch, Ministry of Environment, Victoria, British Columbia.

Subclass Name	*Map Symbol*	*Definitions**
soil creep	c	slow movement of soil
rock creep	g	slow movement of angular debris under periglacial conditions (e.g. rock glaciers)
tension cracks	k	open fissures, commonly near crest of slope
lateral spread		
–in bedrock	p	lateral extension of a fractured mass of bedrock or surficial material; movement is predominantly horizontal
–in surficial material	j	
earthflow	e	slow viscous flow of material containing a high proportion of silt and clay
slump		sliding of internally cohesive masses of bedrock or surficial material along a slip plane that is concave upward or planar
–in bedrock	m	
–in surficial material	u	
slump–earthflow	x	combined slump (upper part) and earthflow (lower part)
debris fall	f	descent of a mass of surficial material by falling, bouncing and rolling
rockfall	b	descent of masses of bedrock by falling, bouncing and rolling
debris slide	s	sliding of disintegrating mass of surficial material
rockslide	r	descent of large masses of disintegrating bedrock by sliding
debris flow	d	rapid flow of saturated debris
debris torrent	t	rapid flow of a mixture of water, earth and vegetation debris down a steep, well–defined stream channel

* After Fairbridge, 1968; Swanston, 1974; Swanston and Swanson, 1976; Varnes, 1978; White, 1981.

Table 3. Subclass modifiers for mass movement processes.

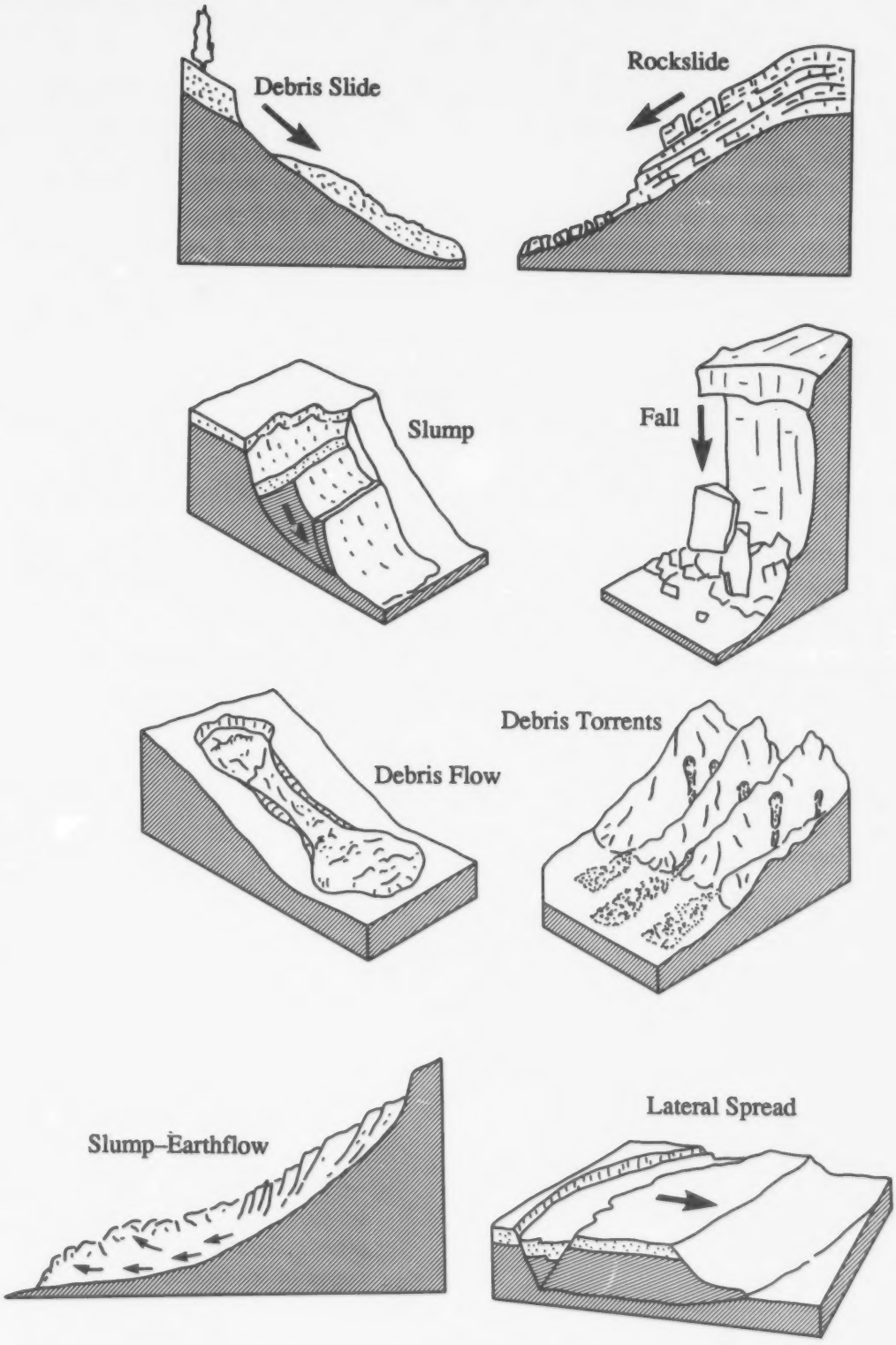


Figure 34. Block diagrams illustrating various types of mass movements (modified from Varnes, 1978).

ON–SITE SYMBOLS

On–site symbols are graphic representations used to describe landforms, features or geological processes not portrayed by terrain unit symbols.

The on–site symbols can be used to indicate linear features such as eskers or moraine ridges; provide site specific information such as gravel locations or kettle holes; and add details of Quaternary history such as striae, glacial meltwater channels or abandoned shorelines. The size of the on–site symbols varies with the type of symbol. For example, those symbols connotating areal extent, such as blockfields or large kettles, vary in size conforming to the shape of the feature. Whereas, those which are point observations are presented as a standard symbol having no relation to areal extent (e.g. fossil locality or observation of frozen ground). Symbols which have linear connotations such as eskers, gullying, or end moraines will vary in length but will be of standard width and may also indicate direction of deposition or process activity.

APPLICATION OF ON–SITE SYMBOLS

On–site symbols are usually depicted on the same map as the terrain units and symbols, however, a separate "Features Map" may be produced to meet specific mapping objectives. On–site symbols should be applied where:

- Landforms, features or geological processes are of insufficient areal extent, or too few in number, to be delineated as terrain units or to be represented in the terrain unit symbol at the scale of mapping.
- It is desirable to indicate the precise location of a landform, feature or geological process whose presence is already identified by the terrain unit symbol.
- The landform or feature cannot be defined by the terrain unit symbol.

LIST OF ON–SITE SYMBOLS

On–site symbols used with this classification system are outlined below. An upper case letter in the notes column indicates if the symbol is standard in terms of shape and size (S), or drawn to actual map scale shape or length (R).

Name	*Symbol*	*Notes*
GLACIAL FEATURES		
Drumlin		ice flow is in the direction of the arrow; symbol is placed in the center of the feature (S)
Crag and tail		ice flow is in the direction of the arrow; symbol is placed in the center of the feature (S)

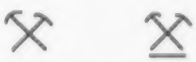
Roches moutenées		ice flow is in the direction of the arrow; symbol is placed in the center of the feature (S)
Striae, grooves (ice flow direction known; unknown)		ice flow is in the direction of the arrow; symbol is placed in the center of the feature (S)
Undifferentiated lineations and flutings		symbol is placed in the center of the feature (S)
Moraine ridge (major)		line drawn along ridge crest (R)
Moraine ridges (minor)		lines drawn along ridge crests (R)
Esker (flow direction known; unknown)		drawn along ridge crest (R)
Kettle holes (large; small)		(R;S)
Meltwater channel (large)		arrow shown if flow direction is known (R)
Meltwater channel (small)		arrowhead shown if flow direction is known (R)
Cirques		line drawn along ridge crest (R)

PERIGLACIAL FEATURES

Blockfield		(R)
Rock Glaciers		(R)

Tors		(S)
Observation of frozen ground		(S)

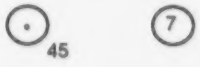
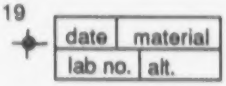
OTHER LANDFORMS AND FEATURES

Dunes (active; inactive)		(S)
Escarpment		hachures extend to base of slope (R)
Strandline		(R)
Piping depression		(S)
Karst depression (large; small)		(R;S)
Gully		symbol follows gully path down-slope (R)
Spring		(S)
Gravel pit (active; abandoned)		(S)
Quarry or mine (active; abandoned)		(S)
Gravel occurrence		(S)
Cinder cone		(S)

MASS MOVEMENT SYMBOLS

Snow avalanche		symbol follows track downslope (R)
Large Landslide:		
headwall scar only		(R)
headwall scar and area affected		(R)
Small Landslide:		
headwall scar only		(S)
headwall scar and track		symbol follows track downslope (R)
Tension cracks		(S)
Sackung (sagging slopes)		(S)

POINT OBSERVATIONS

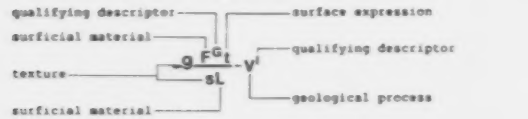
Quaternary fossil site		(S)
Observation site (ground, air)		(S)
Stratigraphic section site		(S)
^{14}C dated site		
		location on map with data recorded in legend (S)
Anthropogenic site		(S)

EXAMPLE TERRAIN MAP AND LEGEND

MAP UNIT LETTER NOTATION

A terrain map unit symbol is composed of combination of letters which designate different characteristics of the terrain. The relative position of letters within the symbol indicates the characteristic that they represent.

SIMPLE TERRAIN UNIT SYMBOL



This map unit consists of a gravelly glaciofluvial terrace that overlies sandy lacustrine materials and is modified by gullies that are no longer active.

Explanatory Notes

1. Units consisting of two or more types of terrain are designated by two or more groups of letters separated by slashes and/or dots (see Composite Units below).
2. Materials underlying the surface unit are shown by a symbol that is written beneath the surface unit symbol and separated from it by a horizontal line.

TEXTURE

Texture refers to the size, roundness and sorting of particles in clastic sediments, and the proportion and degree of decomposition of plant fibre in unconsolidted organic sediments.

Clastic Terms

Symbol	Name	Size(mm)	Other Characteristics
a	blocks	>256	angular particles
b	boulders	>256	rounded & subrounded particles
k	cobbles	64-256	rounded & subrounded particles
p	pebbles	2-64	rounded & subrounded particles
s	sand	.062-2	
z	silt	.002-.062	
c	clay	<.002	
d	mixed fragments	>2	mix of rounded and angular particles
q	gravel	>2	mix of boulders, cobbles and pebbles
a	angular fragments	>2	mix of rubble and blocks
r	rubble	2-256	angular particles
m	mud	>.062	mix of clay and silt
s	shells	-	shell or shell fragments

Organic Terms

Symbol	Name	Characteristics
f	fibric	least decomposed organic material; well-preserved fibre (40%) can be identified as to botanical origin after rubbing.
m	mesic	intermediate decomposition between fibric and mesic
h	humic	advanced decomposed organic material; less than 10% of fibres identified as to botanical origin after rubbing.

Explanatory Notes

1. The absence of a textural term from a unit symbol indicates that texture of the material was not observed in the field and cannot be reliably interpreted from air photos or from a knowledge of the bedrock geology. The reader is referred to surficial material descriptions for general textural information.
2. Where two or three textural terms are used together, they are written in reverse order of importance and indicate that either the various textures are intermixed or interstratified.

QUALIFYING DESCRIPTORS

Qualifying descriptors qualify either surficial material or geological process terms. They are used in order to supply additional information about the mode of formation and/or depositional environment of surficial materials and the status activity of geological processes.

Symbol	Name	Description
G	glacial	Used to qualify non-glacial surficial materials where there is evidence that glacier ice affected the mode of deposition of materials (See surficial materials FG, LG, MG).
A,I	active, inactive	Used to qualify surficial materials and geological processes with regard to their current state of activity. Active: there is evidence that a geological process is either operating continuously or is of a recurrent nature at the present time; there is evidence that the process of formation of a surficial material is operative at the present time. Inactive: there is no evidence to suggest that a geological process is continuing or recurrent; the process of formation of a surficial material has ceased.

Explanatory Notes

An activity qualifying descriptor for surficial materials and geological processes are shown only in unit symbols where the current state of activity is contrary to the designated state.

SURFICIAL MATERIALS

Surficial materials are classified according to their mode of formation or deposition. This influences their physical characteristics such as texture, structure and compaction, which in turn control conditions of drainage and slope stability.

Each surficial material has an assumed status of activity. Status is either active or inactive. It is only indicated when the actual state of formation is contrary to the assumed state defined for each surficial material and is indicated by the Qualifying Descriptor Symbol (see below).

Symbol	Name (Assumed Status of Formative Process)	Description
A	anthropogenic (A)	Man-made or man-modified materials, including those associated with mineral exploitation, waste disposal and landfill.
C	colluvial (A)	Products of mass wastage; generally consists of massive to moderately well-stratified to non-sorted sediments with a variety of particle sizes and shapes; includes talus slopes, avalanche cones, mantles of weathered bedrock, landslide debris, earthflows and debris flows.
D	weathered bedrock(A)	Bedrock decomposed in situ by processes of mechanical and/or chemical weathering; the character of the bedrock debris depends on the process of formation and type of bedrock.
E	eolian (A)	Materials transported and deposited by wind action; generally consist of medium to fine sand and coarse silt that is well-sorted and poorly compacted; includes dunes and loess.
F	fluvial (I)	Materials transported and deposited by streams and rivers, alluvial materials; generally consist of gravel, sand, or silt; gravels are typically well-rounded and contain interstitial sand; sediments tend to be moderately to well-sorted and stratified; includes floodplains, river terraces, deltas, and some alluvial fans.
F^G	glaciofluvial (I)	Fluvial materials deposited in association with glacier ice; generally consist of gravels and sand, and show evidence of ice melting such as kettles and slump structures; sorting, stratification, and particle size and shape are variable; includes kettled outwash, kames, kame terraces and eskers.
I	ice (A)	Permanent snow and ice; glaciers and icefields.
L	lacustrine (I)	Sediments deposited in lakes or reworked by wave action around lake shorelines; generally consist of stratified sand, silt and clay deposited on the lake floor or well-sorted littoral sands or gravels; includes beaches, spits and bars, and lacustrine terraces of silt or clay.
L^G	glaciolacustrine (I)	Lacustrine materials that were deposited in association with glacier ice; generally similar to lacustrine materials but display features such as slump structures, ice-rafted stones and kettles.
M	morainal (I)	Material deposited directly by glaciers, till; generally consists of well-compacted material that is non-stratified and contains a heterogeneous mixture of particle sizes, shapes, and lithologies in a matrix of sand, silt and clay; includes moraines, till plains and drumlins.
O	organic (A)	Material resulting from the accumulation and decay of vegetative matter; generally consists of peat, although minor amounts of marl and inorganic detritus may be included; includes bogs, fens, swamps and thin organic veneers over bedrock (folisols).
R	bedrock (I)	Outcrops and rock covered by less than 10cm of unconsolidated material.
U	differentiated (I)	A layered sequence of more than three types of material outcropping on a scarp slope.
V	volcanic (I)	Unconsolidated pyroclastic sediments including volcanic ash, lapilli and coarser ejecta.
W	marine (I)	Sediments deposited in marine waters, or reworked by wave action along marine shorelines; generally consist of clay, silt, sand or gravel that is sorted and stratified and may contain shells; includes spits bars, beaches and deeper water deposits.
W^G	glaciomarine (I)	Sediments of glacial origin, laid down in a marine environment in close proximity to glacier ice; generally relatively poorly sorted and stratified or massive, and may contain shells; includes marine drift and marine stoney clays.

SURFACE EXPRESSION

Surface expression is the topography or form of the land surface. In general, the terms listed here are used to describe features that are not adequately shown on the topographic base map.

Symbol	Name	Description
a	moderate slope	An unidirectional surface with a slope gradient >15° to >26°; local surface irregularities are less than 1 metre.
b	blanket	A mantle of unconsolidated materials which derives its general surface expression from the topography of the unit which it overlies; it masks minor topographic irregularities in the underlying unit and is more than 1 metre thick; if the underlying unit consists of unconsolidated materials, it is shown in the unit symbol; if no underlying unit is shown, it may be assumed to be bedrock; if the underlying unit consists of unconsolidated materials of unknown origin, then only its surface expression is shown.
c	cone	A cone or segment of a cone with a relatively smooth slope gradient greater than 15°.
d	depression	Circular or irregular area of lower elevation lower than the surrounding terrain; depressions are greater than 2 metres deep.
f	fan	A smooth segment of a cone with a slope gradient up to 15°.
h	hummocky	Steep-sided hillocks and hollows that are rounded or irregular in plan; slopes of 15-35° predominate on unconsolidated materials and slopes of 15-90° predominate on bedrock; local reflief is greater than 1 metre.
j	gentle slope	An unidirectional surface with a slope gradient >3° and <15°; local surface irregularities have a relief <1 metre.
k	moderately steep	unidirectional surface with a slope gradient >25° and <35°; local surface irregularies have a relief <1 metre.
m	rolling	Elongate hillock(s) with slopes dominately between 3 and 15° with local relief >1 metre; in plan an assemblage of parallel or sub-parallel linear forms with subdued relief.
p	plain	A level or gently sloping unidirectional surface with gradients up to 3°; local surface irregularies have a relief of <1 metre.
r	ridged	Elongate or linear, parallel or subparallel hillock(s) or ridges with slopes predominantly between 15 and 35° on unconsolidated materials and between 15 and 90° on bedrock; local relief is >1 metre.
s	steep	Steeply inclined slopes (scarps) with gradients >35° on both unconsolidated materials and bedrock.
t	terraced	Step-like topography; includes both scarp face and the horizontal or gently inclined surface above it.
u	undulating	Gently sloping hillock(s) and hollow(s) with slopes up to 15°; local relief is <1 metre; in plan, an assemblage of non-linear, chaotic forms.
v	veneer	A mantle of unconsolidated materials which has no contructional form of its own, but derives its surface expression from the topography of the underlying unit; it reflects minor irregularities of the underlying surface, is generally between 10 cm and 1 metre in thickness, and outcrops of the underlying unit are common; if the underlying material is unconsolidated, it is included in the unit symbol; if no underlying unit is indicated, it is assumed to be bedrock.

Explanatory Notes

1. The use of two or three surface expressions symbols together implies that there is a mixing of discrete forms, not a set of intermediate forms.
2. Where more than one surface expression symbol is used, the symbols are written in order of decreasing importance based on their areal extent.

ON-SITE SYMBOLS

drumlin, drumlinoid ridge

striae (ice direction known, unknown)

glacial meltwater channel (major)

landslide scar

GEOLOGICAL PROCESSES

These terms indicate geological processes that are currently modifying or have modified surficial materials and surface expressions.

The status of all geological processes are assumed to be active. The exceptions are the processes, channeled by meltwater and kettled which have an asumed status of inactive.

Symbol	Name	(Assumed Process Status)	Description
A	avalanches	(A)	Slopes modified by frequent snow avalanches and by the deposition of rock debris transported by snow avalanches; slopes affected by ice falling from glaciers.
B	braiding channel	(A)	A channel zone characterized by many diverging and converging channels seperated by unvegetated bars and temporary islands of gravel and sand.
C	cryoturbation	(A)	Unconsolidated sediments modified by frost heaving and churning due to frost action; includes patt'erned ground.
D	deflation	(A)	The removal of sand and silt from unconsolidated materials by wind action.
E	channelled	(I)	Erosion and channel formation by meltwater alongside, beneath and in front of a glacier.
F	slow mass movement	(A)	Downslope movement of masses of cohesive or non-cohesive surfical material and/or bedrock by creeping, flowing, or sliding.
H	kettled	(I)	Depressions formed in surficial materials due to the melting of buried, or partially buried glacier ice.
I	irregular channel	(A)	A single, clearly defined main channel displaying irregular turns and bends without repetition of similar features.
J	anastamosing channel	(A)	A channel zone where channels diverge and converge around many islands; the islands are vegetated.
K	karst processes	(A)	Processes associated with the solution of carbonates and other soluble rocks; includes underground and surface weathering and subsidence resulting from solution.
M	meandering channel	(A)	A clearly defined channel characterized by a regular and repeated pattern of bends with relatively uniform amplitude and wave length.
N	nivation	(A)	Erosion of bedrock and surficial materials beneath and along the margin of snow patches by freeze-thaw processes, snow meltwater action and snow creep.
P	piping	(A)	Subterranean erosion of surfical materials by flowing water that results in the formation tubular underground conduits.
R	rapid mass movement	(A)	Rapid downslope movement of dry, moist or saturated debris derived from surficial material and/or bedrock by falling, sliding or flowing.
S	solifluction	(A)	Slow downslope movement of saturated overburden across a frozen or otherwise impermeable substrate.
U	inundation	(A)	Terrain seasonally under standing water which results from high watertable.
V	gully erosion	(A)	Modification of unconsolidated or consolidated surfaces by various processes such as running water, mass movement and snow avalanching that results in parallel or subparallel ravines.
W	washing	(A)	Modification by wave action resulting in lag deposits formed by the removal of fines, and wave cut platforms.
X	permafrost	(A)	Processes controlled by the presence of permafrost, and permafrost aggradation or degradation; permafrost is earth material whose temperature remains below 0° C for more than two continuous years.
Z	general periglacial processes	(A)	Solifluction, cryoturbation and nivation occurring together within a single unit.

Explanatory Note

Geological process symbols are used where a relatively large portion of a terrain map unit is affected by the process. On-site symbols may be used to indicate modification of a small part of the unit by a single or a few features.

COMPOSITE UNITS

Composite units are employed where two or three types of terrain are intermixed or occupy such small areas that they cannot be designated as separate units at the scale of mapping. Symbols (defined below) are used to indicate the relative amounts of each terrain type, and the components are always written in decreasing order of importance.

.	The components on either side of this symbol are approximately equal
/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the one that follows

For example:

Mb//R	Mb is considerably more extensive than R
Mb//R.Cv	Mb is considerably more extensive than R; R and Cv are of roughly equal extent
Mb/R//Cv	R is less extensive than Mb; Cv is considerably less than R.

Scale 1:50 000 Échelle

Miles 1 0 1 2 3 Miles

Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Verges

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APPENDIX I

GLOSSARY OF TERMS

The following definitions draw heavily from "The Glossary of Geology" by The American Geological Institute (1980).

BEDDING: Collective term for the existence of beds or laminae. A bed is separated by a more or less well–defined divisional plane from its neighbours above and below. 1) Well–bedded — when beds are immediately apparent, clearly defined and can be easily traced across the deposit. 2) Moderately–bedded — intermediate between 1) and 3). 3) Poorly–bedded — when beds are only discerned after careful scrutiny, or bedding planes are discontinuous.

BLOCKFIELDS: (syn. Felsenmeer) A level or gently sloping area covered with moderate sized or large blocks of rock that have been derived from the underlying bedrock by frost shattering.

BOG: An area covered or filled with peat material which generally consist of undecomposed to moderately decomposed sphagnum mosses.

CARBONATE ROCKS: A rock composed of carbonate minerals; most commonly limestone or dolomite; a sedimentary rock composed of more than 50% by weight of carbonate minerals.

CAST: A structure formed when the external, skeletal or other organic structural part of an organism has been dissolved and the resulting space is replaced by a secondary material, producing a replica of the original form.

CINDER CONE: A conical hill formed by the accumulation of cinders and other pyroclastic sediments, normally of basaltic or andesidic composition.

CIRQUE: A step–walled, half bowl–like recess, horseshoe or semi–circular in plan, situated high on the side of a mountain produced by the erosive activity of a mountain glacier.

CLAST: An individual constituent or particle of a detrital sediment or sedimentary rock initially produced by the disintegration of a larger mass.

COHESION: The capacity of particles to stick or adhere together. In effect, all of the shear strength of a material not due to friction.

COMPACTION: The degree of packing of the individual particles of detrital sediments.

CRAG AND TAIL: A hill of bedrock having a steep face of ice–smoothed resistant bedrock (the crag) with a long sloping tail of drift streaming behind it.

CREEP: The imperceptibly slow, more or less continuous downward and outward movement of soil or rock on slopes. The movement is essentially viscous, under shear stresses sufficient to produce permanent deformation but too small to produce shear failure as in a landslide.

CREVASSE: A fissure in the ice formed under the influence of various strains.

CREVASSE FILLING: Generally, a short, straight ridge made up of unconsolidated sediments (till or sand and gravel) that were initially deposited in a crevasse that has subsequently been deposited on the earth's surface after the ice melted.

CROSSBEDDING: The arrangement of laminations or beds transverse or oblique to the main planes of stratification of the deposit concerned; included are often lenticular beds between the main bedding planes; found only in granular sediments.

DELTA: A landform that is commonly nearly flat and triangular or fan–shaped, made up of gravel, sand and/or finer sediments that are deposited by a river discharging into a sea or lake.

DIAMICTON: Applied to non–sorted or poorly–sorted, heterogeneous sediments containing a wide range of particle sizes in a muddy matrix.

DRIFT: Any material, such as boulders, till, gravel, sand or clay, transported by a glacier, and subsequently deposited directly from the ice or by its meltwater. Also commonly used to include non–glacial unconsolidated sediments.

DRUMLIN: A streamlined hill or ridge of till with the long axis paralleling direction of flow of a former glacier; generally it has an elliptical base and arched profile with a long gentle slope pointing in the downstream direction.

EPHEMERAL: Used here in association with streams and lakes to indicate seasonal or short term in occurrence.

ESKER: A sinuous low ridge composed of sand and gravel formed by deposition from meltwater running through a channel beneath or within glacier ice.

FEN: An area covered or filled with peat material which generally consists of well to moderately decomposed sedge (carex spp.) species.

FLOODPLAIN: Flat land that is subject to flooding bordering a river; consists primarily of unconsolidated depositional material derived from sediments being transported by the related river.

FLOWTILL: Superglacial debris (ablation moraine) that moved laterally as a mudflow from glacier ice to an adjacent lower surface.

FLUTED SURFACE: A surface made of parallel gutter–like furrows with intervening ridges that are developed in bedrock, till or stratified drift.

FROSTING: A lusterless, ground–glass, or mat surface imposed on the surface of rounded quartz grains because of innumerable close contacts with other similar grains.

GRUS: The fragmental products of in situ granular disintegration of granite and granitic rocks by chemical processes (e.g. hydrolysis).

HOLOCENE: An epoch in geologic time extending from approximately 10,000 years ago to present.

HYDROPHYTIC VEGETATION: Vegetation with an affinity to wet sites.

ICE–RAFTED STONES: Stones deposited in lacustrine or marine sediments from the melting of floating ice.

INTERSTITIAL: Occurring within the pore spaces of a particulate sediment; of, pertaining to, existing in, or forming an interstice or interstices.

KAME: A steep sided hill or short ridge of stratified drift, formed in contact with glacier ice.

KAME TERRACE: A remnant terrace of stratified drift deposited between a valley ice lobe and the bounding side slope of the valley.

KAME–AND–KETTLE TOPOGRAPHY: Surface formed of a kame complex interspersed with kettles.

KNOB–AND–KETTLE TOPOGRAPHY: Irregular surface formed of hillocks and scattered kettles; may refer to either morainal or kame topography.

LAG DEPOSIT (syn. lag gravel): Residual deposit of coarse material that has had the finer fraction removed by a transporting agent, usually wind or water.

LAPILLI: Volcanic projectile; typically small broken fragments or cinders ranging mostly from 2mm to 64mm in diameter.

LEVEES (natural): A low, wide ridge immediately adjacent to a river channel.

LIMESTONE PAVEMENT: A flat exposure of bare limestone resembling a paved road in smoothness, hardness, and surface extent, consisting of flat or ridged irregularly sized and shaped blocks, separated by clefts formed by the widening of joints by solution.

LITTORAL: Belonging to, inhabiting or taking place on or near the shore.

LOBES (solifluction lobes): Tongue–like mass of solifluction debris commonly with steep front and sides and relatively gentle upper surface.

LOESS: Largely homogeneous, nonstratified silt and fine sand of eolian origin.

MARL: Soft, unconsolidated calcium carbonate, usually mixed with varying amounts of clay and other impurities.

MASSIVE: A homogeneous structure, without stratification, flow–banding, foliation, or bedding.

MASS WASTING: A general term for a variety of processes by which large masses of earth material are moved by gravity, either slowly or quickly, from one place to another.

MATRIX: In a rock or deposit made up of small and larger sized grains, the grains of the smaller size comprise the matrix.

MICRORELIEF: Small, or relatively small elevations or inequalities, collectively, of a land surface; generally less than 1 metre amplitude.

MIDDEN: A heap or stratum of refuse (broken tools, shells, ashes, etc.) normally found on the site of an ancient settlement.

MUDFLOW: A flow comprised of heterogeneous debris (including much silt–clay matrix), lubricated with a large amount of water, usually flowing in a former stream course.

NEO–GLACIAL MORAINE: Moraines formed by the re–advance of mountain glaciers during a "Little Ice Age".

NON–SORTED: See sorting.

OGIVES: Curved dark and light bands that are convex downslope and visible on a glacier surface.

OUTWASH: Stratified drift transported and deposited by meltwater streams beyond the glacier.

PYROCLASTIC SEDIMENTS: A general term applied to detrital volcanic materials that have been explosively or aerially ejected from a volcanic vent.

QUATERNARY: The most recent geological time period; subdivided into Pleistocene and Holocene (Recent).

ROCK GLACIER: A lobe–shaped accumulation of angular fragments resembling a small glacier. The motion is the result of flow of interstitial ice.

ROUCHE MOUTENEES (stoss–and–lee): Bedrock outcrops that have a gentle abraided slope on the upstream (stoss side) and a somewhat steeper, quarried lee slope formed by glacial erosion.

SAPROLITE: Weathered bedrock decomposed in situ by processes of chemical weathering.

SLUMP STRUCTURES: Disturbed bedding or stratification within a deposit, which indicates material has moved downslope due to gravity since its deposition.

SHEETS (solifluction sheets): Broad deposit of non–sorted, water saturated, locally derived material which has moved or is moving downslope.

SINKHOLES (dolines): A funnel shaped depression in the land surface generally in a limestone region communicating with a subterranean passage developed by solution.

SOLUTION: The process whereby solid matter dissolves in a liquid; commonly used to refer to the dissolving of limestone (calcium carbonate) in rain and ground water.

SORTING: Refers to the variation of particle sizes within a sedimentary unit; statistically it is a measure of the spread of the particle size distribution on either side of the mean. Well–sorted — particles of uniform size; non–sorted — a wide variation of particle size.

STRATIFICATION: Horizontal or inclined structure in a sedimentary unit that results from its mode of deposition; includes beds, laminae, abrupt and gradational textural changes, and orientation of particles.

STRIAE: Fine cut lines on the surface of bedrock or a clast surface formed by glacial abrasion.

STRUCTURE: The arrangement of particles and beds within a deposit; ie. bedding structures, stratification, laminations, faults and folds.

SUPRAGLACIAL MORAINE: Till on the surface of glacier ice; a consequence of debris melting out from the ice and/or falling from the valley sides.

SWAMP: A level or slightly concave area covered or filled with peat material which generally consists of decomposed sedge or feathermoss species. The watertable is generally at or above the peat surface. The vegetation is usually characterized by a tree cover of cedar and spruce.

SWELL AND SWALE TOPOGRAPHY: A low–relief, undulating landscape exhibiting gentle slopes and well–rounded hills interspersed with shallow depressions.

TALUS (scree) SLOPE: An accumulation of sharp angular rock fragments at the base of a cliff produced by frost action and other processes from an exposed bedrock slope.

TEPHRA: A general term for all pyroclastic sediments of a volcano.

UVALAS: A large collapse feature in a limestone region formed when the supporting wall between sinkholes breaks down.

VOLCANIC ASH: Fine pyroclastic material less than 2mm in size.

WASHBOARD MORAINE: A series of small parallel or subparallel moraines that form a ridged topography orientated transverse to ice movement.

WELL–SORTED: See sorting.

WENTWORTH PARTICLE SIZE SCALE: A logarithmic grade scale for size classification of sediment particles.

APPENDIX II

FIELD DETERMINATION OF TEXTURE FOR SAND, SILT AND CLAY

The texture of sand and finer textured materials can be determined in the field by "feel" (hand texturing). Comparisons of the results from both field examinations and laboratory analysis should be made whenever possible. A number of tests can be done in the field to establish the texture of a sediment, including: (1) moist cast test; (2) ribbon test; (3) feel tests; (4) taste test; and (5) shine test.

Moist Cast Test: Involves squeezing (compressing) a moist soil sample in your hand. If the soil holds together (i.e. forms a cast), then toss from hand to hand to test strength of cast. The more durable the cast is the more clay present.

Ribbon Test: Roll moist soil into cigarette–shape between palms of hands, then roll out between thumb and forefinger forming the longest, thinnest ribbon possible.

Feel Tests: Includes graininess test, dry feel test, and stickiness test.

Graininess Test: Soil is rubbed between thumb and fingers to assess the percent sand by the grainy feel of the sample.

Dry Feel Test: Start with moist soil samples with more than 50% sand. Sample is rubbed in the palm of the hand to dry it, and to separate and estimate, the size of the individual sand particles. The sand particles will then fall out of the hand and the amount of finer material (silt and clay) remaining can be noted.

Stickiness Test: Knead a saturated soil sample until the stickiest point is reached. Then compress between the thumb and forefinger. The degree of stickiness is determined by noting how strongly it adheres to the thumb and forefinger upon release of pressure and how much it stretches.

Taste Test: Work a small amount of soil between front teeth. Sand is distinguished as individual grains against the teeth. Silt particles, as a group, have a general fine grittiness, but individual grains cannot be identified. Clay particles have no grittiness (smooth).

Shine Test: A small amount of moderately dry soil is rolled into a ball and rubbed once or twice against a hard, smooth object such as a knife blade or thumb nail. A shine on the ball indicates clay in the soil.

GUIDE TO THE IDENTIFICATION OF THE MAIN TYPES OF FINE SEDIMENTS

This section describes some of the characteristics for certain classes of fine textured sediments. It is intended to be a guide that is not all inclusive. Additional combinations of sand, silt, and clay may occur.

Sand: Material made up of sand has a grainy feel and individual sand particles can be readily seen, felt or tasted. Dry sand, when squeezed in the hand, will fall apart when the pressure is released. Moist sand will form a weak cast when squeezed that falls apart when touched.

Silt: Material made up of silt feels like flour when pulverized and dry, and has a soapy, non–sticky feel when the sediment is very moist. Silt has a gritty taste when chewed between the teeth. Dry or moist, this material will form a weak cast that can be carefully handled. When moist, silt flakes rather than forming a ribbon.

Clay: Material made up of clay has a smooth feel (no graininess) and is plastic and usually very sticky when wet. It has a smooth taste when chewed. Moist sediment will form a very strong cast when pressure is applied, a roll will bear its own weight when flexed and it will form a very thin, long, flexible ribbon (>7.5cm). It produces a strong shine when rolled into a ball and rubbed once or twice against a hard surface.

Silty Sand: Material that is made up of sand, with a lesser amount of silt (20–49%) and that may contain from 0 to 19% clay. There is sufficient finer material (silt and clay) to make it somewhat coherent. Individual sand grains can be seen, felt or tasted. The material feels very grainy with a secondary strong floury feel and may be slightly sticky. If squeezed it will form a weak to moderate cast (depending on the amount of silt/clay present) that will bear careful handling without breaking. No shine is evident. (A silty sand is roughly equivalent to the sandy loam to "light" loam soil textures.)

Sandy Silt: Material that is made up of silt with lesser amount of sand (20–49%) and that may contain from 0 to 19% clay. It has a floury with slight graininess feel and may be slightly sticky when wet. When chewed, it has a silt grittiness with some sand graininess. It forms a weak to moderate cast that allows for careful handling and it flakes rather than forming a coherent ribbon or barely forms a ribbon. No shine is produced. (A sandy silt is roughly equivalent to the silt loam to loam soil texture.)

Clayey Sand: Material that is made up of sand with a lesser amount of clay (20–49%) and that may contain from 0 to 19% silt. It has a grainy feel (individual sand grains are evident) that is slightly to moderately sticky. The sediment forms a moderate to strong cast; a short (<3cm), thick to a long (5 to 7.5cm), thin ribbon that holds its' own weight; and the sediment has a slight to moderate shine. (A clayey sand is roughly equivalent to sandy clay loam and sandy clay soil textures.)

Clayey Silt: Material made up of silt with a lesser amount of clay (20–49%) and that may contain from 0 to 19% sand. It has a smooth to smooth with floury feel depending on the amount of silt present and silt grittiness when chewed. The material is sticky to very sticky; forms a strong to very strong cast; produces a slight to moderate shine; and forms fairly thin ribbons barely able to support their own weight, to thin, long (5 to 7.5cm) ribbons which readily support their own weight. (A clayey silt is roughly equivalent to a silty clay loam to silty clay soil texture.)

Sand/Silt/Clay (in any order): Sediments made up of at least 20% sand, 20% silt and 20% clay should display the following characteristics: (1) some to moderate graininess with sand grains evident and should be slightly sticky to sticky when moist, (2) barely forms ribbons to thin ribbons that barely supports own weight, (3) forms a moderate to strong cast when clenched, and (4) may produce a slight shine when rolled and rubbed. (A mixture of sand/silt/clay is roughly equivalent to a clay loam to "heavy" loam soil texture.)

APPENDIX III

COMPUTER AIDED INTERPRETATION OF TERRAIN (SURFICIAL GEOLOGY) DATA BY "CAPAMP"

INTRODUCTION

The "Computer Assisted Planning, Assessment and Map Production" (CAPAMP) system is the British Columbia Ministry of Environment thematic mapping geographic information system. The system is specifically designed to deal with thematic mapping applications. The system is managed and operated by the Surveys and Resource Mapping Branch.

Most of the work on CAPAMP has been project specific, aimed at producing a wide variety of interpretive products from natural resource mapping. Highly standardized map and associated attribute data input into the system in addition to terrain data includes: soils, wildlife habitat, biogeoclimatic and forest cover. Many other kinds of data such as climate zones, watershed divides and land use boundaries may also be entered.

Terrain data on CAPAMP has been used to generate a wide range of interpretive map products and tabular reports, including: potential sources of sand and gravel, generalized terrain maps, potential terrain hazards maps, landslide prediction maps, a series of interpretations related to forestry, wildlife and fisheries management, and potential impact assessments for major resource development planning. Figure 35 is an example of an interpretive product derived from terrain data on CAPAMP. To produce such products from the input data it is necessary to devise algorithms consisting of if–then–else statements, mathematical equations and other logical constructs. These algorithms are typically developed by a small project team. In addition to system analysts, the team generally includes someone who was involved with the initial data collection and one or more professionals with expertise in the interpretations to be made. These algorithms once developed are maintained as a library to be applied to new databases with appropriate modifications as required. The library presently contains over forty interpretations. Thus, the emphasis with CAPAMP is to produce a series of project specific interpretive maps and tables, tailor made for a variety of users in Environment and elsewhere in government.

USING CAPAMP

The project flow with CAPAMP proceeds through a number of steps, commencing with the assembly of a project team and the creation of a project plan. All of the data within CAPAMP are entered typically on a mapsheet basis. First, the terrain map is digitized to capture the thematic map base, including the polygon lines and on–site symbols. Then for each bounded area, or polygon, a series of data items may be entered on the Terrain (Surficial Geology) coding sheets (Figure 36) or by using a computer terminal. The data are then passed through a series of edit and validation routines to flag errors and ensure a relatively "clean" database. Meanwhile logic for the interpretive algorithms is defined and the required computer programs are developed and tested. Some of the algorithms may have already been implemented on previous terrain projects. After the data and algorithms are deemed acceptable, the final tables and maps are generated.

Natural mass movement rating (see **A**) — Clearcut Landslide rating (see **B**) — Potential Introduced landslide debris rating (see **C**)

*** 3+:H-L**

This symbol indicates that (1) natural landslides have occured within this polygon (*symbol); (2) there is a moderate liklihood that rapid mass movements and/or slumps will occur following clearcut operations (3+ symbol); and, (3) if a landslide should occur, there is a high likelihood that the landside debris will impact upon the stream system and possibly, be deposited into a lake (H-L symbol)

A NATURAL MASS MOVEMENT RATING

Symbol	*Description*
*	Indicates that at least one or more shallow rapid mass movements and/or slumps in unconsolidated material in a natural setting has initiated within the polygon.

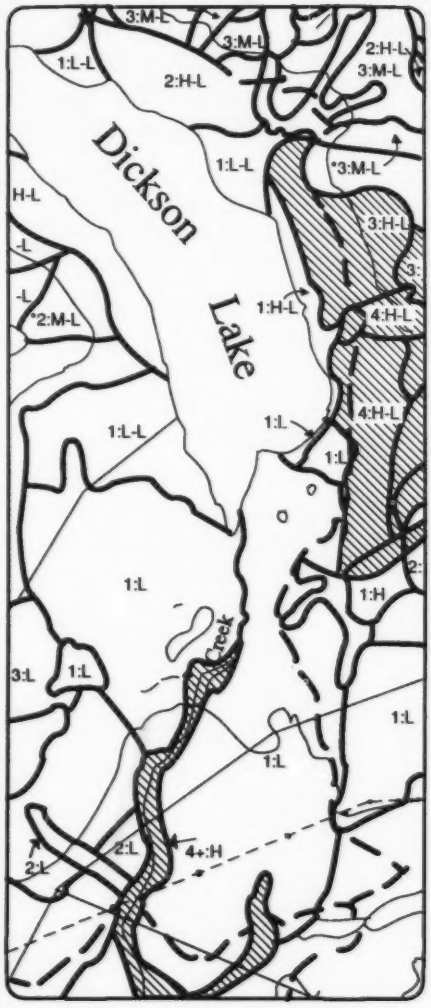
B CLEARCUT LANDSIDE RATING

Symbol	*Description*
4	Terrain polygons that have a high likelihood of clearcut rapid mass movements occuring following clearcut operations (≥0.100 failures per hectare).
3	Terrain polygons that have a moderate likelihood of clearcut rapid mass movements occuring following clearcut operations (≥0.05 to <0.100 failure per hectare).
2	Terrain polygons that have a low likelihood of clearcut rapid mass movements occuring following clearcut operations (≥0.010 to <0.05 failure per hectare).
1	Terrain polygons that have a very low likelihood of clearcut rapid mass movements occuring following clearcut operations (<0.0100 failure per hectare).
+	Terrain polygons that have a moderate likelihood of clearcut slumps occuring following forestry operations (≥0.05 to <0.10 failure per hectare).

C POTENTIAL INTRODUCED LANDSLIDE DEBRIS RATING

Potential introduced landslide debris is a qualitative rating of the likelihood of clearcut landslide debris entering the stream system if a landslide should occur within a terrain polygon. The stream system includes stream order one and two channels, and gullies.

H	There is a high likelihood of landslide debris impacting upon the stream system, if a clearcut landslide (i.e. rapid mass movement, slump) should occur in these terrain polygons. (Most clearcut rapid mass movements and slumps occuring in these areas are expected to impact upon the stream system).
M	There is a moderate likelihood of landslide debris impacting upon the stream system, if a clearcut landslide (i.e. rapid mass movement, slump) should occur in these terrain polygons. (Some of the clearcut rapid mass movements and slumps in unconsolidated materials occuring in these areas are expected to impact upon the stream system).
L	There is a low likelihood of landslide debris impacting upon the stream system, if a clearcut landslide (i.e. rapid mass movement, slump) should occur in these terrain polygons. (Few of the clearcut rapid mass movements and slumps occuring in these areas are expected to impact upon the stream system).
–L	This symbol is used to modify the potential introduced landslide debris rating and indicates that landslide derived debris may be deposited into a lake.



(from Howes, 1987)

Terrain polygons covered by this pattern represent those areas that have a clearcut landslide rating of 4 and a potential introduced landslide debris rating of H (High) or M (Moderate), or areas that have a clearcut landslide rating of 3 and a potential introduced landslide debris rating of H (High).

Figure 35. Example of a CAPAMP Derived Slope Hazard Map.

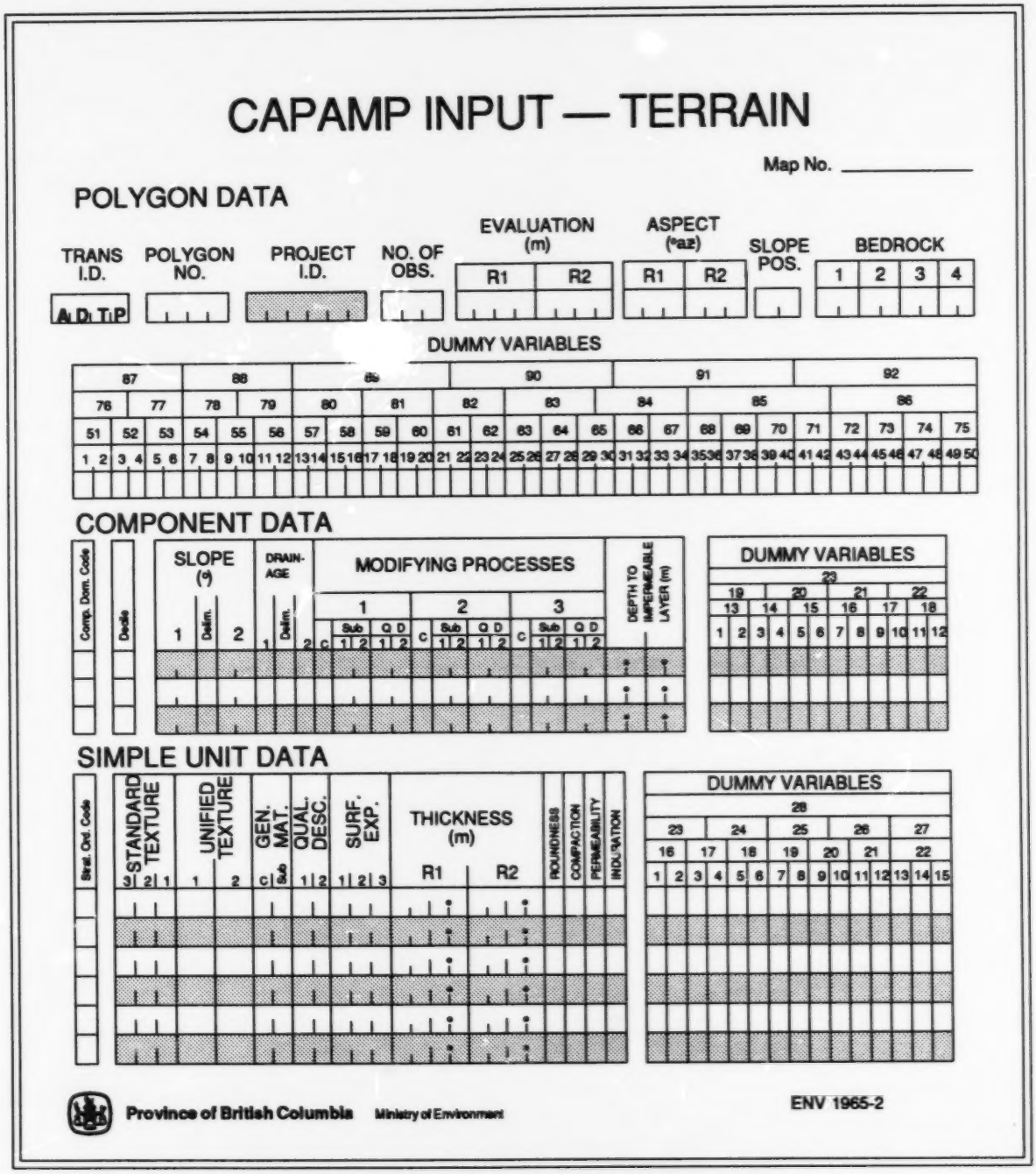


Figure 36. Example of Terrain (Surficial Geology) Form.

The Terrain (Surficial Geology) coding form allows for the entry of all pertinent attribute data associated with the terrain map. All the information associated with the terrain polygon symbol can be captured as well as other potentially pertinent terrain related attributes. The form accommodates:

- Data applicable to the entire polygon including elevation, aspect, slope position and bedrock.
- Data defining up to three polygon components including the depth to impermeable layer in each component.
- Data specific to the stratigraphic layers (up to six in total) comprising the components, including standard terrain texture, unified texture, clast roundness, degree of compaction, material permeability and degree of induration.
- Data attributes which may be required on an individual project basis further defining the polygon, components or stratigraphic layers.

Complete, detailed instructions for filling out the Terrain coding form, including attribute definitions, allowable codes and coding rules are provided in "CAPAMP Volume 1: Data Entry and Validation Procedures for Soil, Agriculture Capability, Surficial Geology and the All Purpose Entity", by E. Kenk, M. W. Sondheim and H. Quesnel, (1987), available from MAPS BC, 553 Superior Street, Victoria, British Columbia, V8V 1X5. This document provides the necessary background to undertake and successfully complete a terrain project, making use of the automated analytical and map and report generation capabilities of the CAPAMP system. In addition to showing how to fill out the Terrain data form, it gives an overview of the CAPAMP system, describing the system structure, function and support facilities. Recommendations concerning CAPAMP terrain data collection, input, and analysis are given as are examples of some of the past uses of CAPAMP by resource professionals.

APPENDIX IV

A LIST OF EMENDATIONS TO THE 1976 TERRAIN CLASSIFICATION SYSTEM

A number of changes, including additions, deletions and modifications, have been incorporated into this edition of the "Terrain Classification System" with the intent of improving its' information capacity and flexibility. Following is a summary of these changes or specific topic areas where changes have occurred from the 1976 version. The changes are grouped according to the main components of the terrain mapping system.

Texture

1) The transfer of the texture term blocky from the common clastic category to the specific clastic category.

2) The addition of the common clastic terms mixed fragments, angular fragments, mud and shells.

3) The symbol for the organic texture term mesic is changed from "m" to "u".

4) Up to three texture terms may be used to describe a surficial material rather than two and the percent ranges for the various combinations of texture terms is defined.

Surficial Material

1) The term genetic material has been replaced by surficial material.

2) The surficial material term saprolite has been deleted.

3) The surficial material term weathered bedrock has been added.

4) The surficial materials glaciofluvial, glaciolacustrine and glaciomarine are now defined in this section.

Surface Expression

1) Slope angles for hummocky and ridged have been redefined.

2) The term apron has been deleted.

3) Slopes for fan are specified.

4) Subdued and level have been replaced by rolling and undulating topography and plain. Slopes have been redefined.

5) The surface expression terms moderate slope, depression, gentle slope, moderately steep slope and undulating topography have been added.

6) When more than one surface expression term is used, the symbols will now be written in order of decreasing importance.

Geological Processes

1) Modifying processes has been replaced by geological processes.

2) The term beveled has been deleted.

3) Channeled has been restricted to only meaning channeled by meltwater. The symbol notation "E" replaces "E^{G}".

4) The term failing has been replaced by the more specific terms slow mass movements and rapid mass movements.

5) The following geological process terms have been added: braiding channel, irregularly sinuous channel, anastamosing channel, meandering channel general periglacial processes, permafrost processes and inundated.

Qualifying Descriptors

1) The organic qualifying descriptors bog, fen and swamp have been deleted.

Other Changes

1) Where appropriate, the use of deciles to indicate the proportion of each terrain symbol component is recommended (especially if computer application of the data is planned).

2) The terrain classification system now incorporates the concept of subclass modifiers. Subclass modifiers are a functional tool used in a terrain unit symbol to provide further information about a surficial material or geological process. The subclass modifiers can be designed to provide extra information not formally provided for by the terrain classification system but is required to meet the objectives of a particular survey or type of survey.

3) The list of on–site symbols has been expanded and some symbols have been changed.

4) The glossary has been expanded.

5) The guidelines for field determination of texture has been revised.

6) An introduction for inputting terrain data on the British Columbia Ministry of Environment thematic mapping geographic information system referred to as the CAPAMP (Computer Assisted Planning, Assessment and Map Production) system is included for reference.

FIELD CARD OF CODES.

TERRAIN CLASSIFICATION SYSTEM FOR BRITISH COLUMBIA
CODES AND DESCRIPTIONS

TEXTURE

Symbol	Name	Size(mm)	Other Characteristics
s	blocks	>256	angular particles
b	boulders	>256	rounded & subrounded particles
k	cobbles	64-256	rounded & subrounded particles
p	pebbles	2-64	rounded & subrounded particles
a	sand	.062-2	
d	silt	.002-.062	
c	clay	<.002	
d	mixed fragments	>2	mix of rounded and angular particles
g	gravel	>2	mix of boulders, cobbles and pebbles
x	angular fragments	>2	mix of rubble and blocks
r	rubble	2-256	angular particles
m	mud	<.062	mix of clay and silt
y	shells	-	shell or shell fragments
e	fibric	well-preserved fibre; (40%) identified after rubbing	
u	mesic	intermediate decomposition between fibric and mesic	
h	humic	decomposed organic material; (10%) identified after rubbing	

SURFICIAL MATERIALS

Symbol	Name	(Assumed Status of of Formative Process)	Description
A	anthropogenic	(A)	Man-made or man-modified materials
C	colluvial	(A)	Products of mass wastage
D	weathered bedrock	(A)	In situ, decomposed bedrock
E	eolian	(I)	Materials deposited by wind action
F	fluvial	(I)	River deposits
FG	glaciofluvial	(I)	Ice contact fluvial materials
I	ice	(A)	Permanent snow, glaciers and icefields
L	lacustrine	(I)	Lake sediments; includes wave deposits
LG	glaciolacustrine	(I)	Ice contact lacustrine materials
M	morainal	(I)	Material deposited directly by glaciers
O	organic	(A)	Accumulation/decay of vegetative matter
R	bedrock	(-)	Outcrops/rock covered by less than 10cm
U	undifferentiated	(-)	Layered sequence; three materials or more
V	volcanic	(I)	Unconsolidated pyroclastic sediments
W	marine	(I)	Marine sediments; includes wave deposits
WG	glaciomarine	(I)	Ice contact marine sediments

QUALIFYING DESCRIPTORS

Symbol	Name	Description
G	glacial	Used to qualify surficial materials where there is evidence that glacier ice affected the mode of deposition of materials
A	active,	Used to qualify surficial materials and geological processes
I	inactive	with regard to their current state of activity

SURFACE EXPRESSION

Symbol	Name	Description
a	moderate slope	Unidirectional surface; >15° to ≤26°
b	blanket	A mantle of unconsolidated materials; >1m thick
c	cone	A cone or segment of a cone; >15°
d	depression	A lower area enclosed by higher surrounding terrain
f	fan	A segment of a cone; up to 15°
h	hummocky	Hillocks and hollows, irregular in plan; 15-35°
j	gentle slope	Unidirectional surface; >3° and ≤15°
k	moderately steep	Unidirectional surface; >26° and ≤35°
m	rolling	Elongate hillocks; 3 to 15°; parallel forms in plan
p	plain	Unidirectional surface; up to 3°
r	ridged	Elongate hillocks; 15 to 35°; parallel forms in plan
s	steep	Steep slopes; >35°
t	terraced	Step-like topography
u	undulating	Hillocks and hollow; up to ≤15°; irregular in plan
v	veneer	Mantle of unconsolidated material; 10cm to 1m thick

GEOLOGICAL PROCESSES

Symbol	Name	(Assumed Process Status)	Description
A	avalanches	(A)	Terrain modified by snow avalanches
B	braiding	(A)	Diverging/converging channels; unvegetated bars
C	cryoturbation	(A)	Sediments modified by frost heaving and churning
D	deflation	(A)	Removal of sand and silt by wind action
E	channelled	(I)	Channel formation by meltwater
F	slow mass movement	(A)	Slow downslope movement of masses of cohesive or non-cohesive material and/or bedrock
H	kettled	(I)	Depressions due to the melting of buried glacier ice
I	irregular channel	(A)	A single, clearly defined main channel displaying irregular turns and bends
J	anastamosing channel	(A)	A channel zone where channels diverge and converge converge around many vegetated islands
K	karst	(A)	Processes associated with the solution of carbonates
M	meandering channel	(A)	Channel characterized by a regular pattern of bends with uniform amplitude and wave length
N	nivation	(A)	Erosion beneath and along the margin of snow patches
P	piping	(A)	Subterranean erosion by flowing water
R	rapid mass movement	(A)	Rapid downslope movement of dry, moist or saturated debris
S	solifluction	(A)	Slow downslope movement of saturated overburden across a frozen or otherwise impermeable substrate
U	inundation	(A)	Seasonally under water due to high watertable
V	gully erosion	(A)	Parallel/subparallel ravines due to running water
W	washing	(A)	Modification by wave action
X	permafrost	(A)	Processes controlled by the presence of permafrost
Z	periglacial processes	(A)	Solifluction, cryoturbation and nivation processes occurring within a single unit

ON-SITE SYMBOLS